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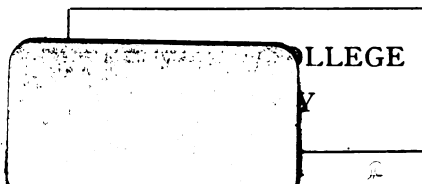
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GRADED LESSONS IN NUMBER

PART II.

GRAMMAR SCHOOL
ARITHMETIC

EXTENDING OVER THE COURSE OF GRADED
GRAMMAR SCHOOL WORK

By Wm. M. Peck

THIRD EDITION REVISED.

NEW YORK
A. LOVELL & COMPANY

1900

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PREFACE.

This book has been prepared for the pupils of our common schools with two special objects in view: to train the mind of the child to acquire facility and accuracy in the fundamental use of number, in both oral and written work, in an orderly and natural way; and to prepare him for the business of daily life. The author has also had in view the needs of the many children who are compelled to leave school at an early age and who have no time to spend in learning the definitions and theories of arithmetic, but who need a great deal of practice in the essentials of the subject.

The problems have been constructed with special reference to utility and business needs, and they are written in definite arithmetical language within the comprehension of the child.

An important feature is the arrangement of the lessons, each of which consists of fifteen concrete problems—five mental and ten written. The five mental problems are similar in appearance and process of solution to the ten written problems which follow, and are to be used as an introductory lesson.

Teachers will at once note the peculiar advantage of a book in which mental and written work are combined in the same lesson. It furnishes matter which hitherto they have been obliged to find elsewhere or entirely neglect. This plan leads the pupil by easy and gradual stages from the mastery of the simple to the comprehension of the more difficult and complex, and is in accord with the methods of our best and most successful educators who drill their pupils in mental problems before proceeding to others of

similar character involving the same principles, but containing larger numbers and more complex terms.

Daily practice in this work must result in a great increase of mental power and in the securing of ability on the part of pupils to rely upon intellectual work and not upon pencil and paper in the solution of arithmetical problems.

The problems are graded in such a way as will best secure clearness of thought, logical habits, rapidity and accuracy in calculation.

Especial attention has been given to the training in practical business methods, the development of the power of fixed habits of attention, and the cultivation of lucid processes of reasoning.

The problems are all based on recent and reliable data, and drawn from the experiences and usages of business men in the various occupations of the farm, the workshop and the counting-room.

The methods employed are those which practical experience and test in the schoolroom have shown to be the best. All obsolete subjects, terms and other matter heretofore considered necessary in arithmetic, but which modern progress has rendered useless, have been purposely omitted. That portion called *Supplementary Arithmetic* has been added to supply the wants of schools which require a more extended course, or are under the Regent's, and whose examinations demand a knowledge of more advanced subjects in arithmetic.

Following the plan of Part I. of this Series, a suggestive four years' course is given for the guidance of the teacher, which correctly outlines and divides each year's work.

W. M. P.

May, 1894.

TWO HUNDRED GRADED BUSINESS PROBLEMS.

I.

1. James Brown earns \$1,250 a year. If it cost him \$875 for living expenses, how much money will he save in five years ?

2. Bought a suit of clothes for \$42.50, an overcoat for \$22.75, a pair of boots for \$5.25, and a hat for \$4.63. What was the amount of the bill ?

3. Samuel Jones gave \$73 for a watch, \$15.50 for a carriage robe, \$250 for a horse, and sold them so that he gained \$21.50. What did he receive for all together ?

4. A grocer bought 6 cheeses, each weighing 75 pounds. How much did he pay for them, if they were worth 15 cents a pound ?

5. A man bought a coat for \$12.75, and a hat for \$4.50. How much change ought he to get back from a \$20-bill ?

6. A man having \$90.75, lacks how much of having enough to purchase a watch and chain worth \$125 ?

7. What cost 5 pounds 4 oz. of coffee at 20 cents a pound ?

8. A milkman buys milk at 12 cents a gallon, and retails it at 5 cents a quart. Find his gain on a 10-gallon can.

9. A man sold 108 acres of land at \$225 an acre, and with the money bought horses at \$75 each. How many did he get?

10. A farmer sold 40 barrels of apples at \$3 per barrel, 65 barrels of potatoes at \$2 per barrel, and received in payment 40 barrels of flour at \$6 per barrel, and the balance in cash. How many dollars did he receive?

II.

1. A stock farmer had 63 cows; $\frac{2}{3}$ of them died, and he sold the rest for \$35 each. How much money did he receive?

2. If $\frac{1}{2}$ pound of butter cost 16 cents, how much should a grocer pay for a dozen tubs, each weighing 65 pounds?

3. A lady had \$375, and spent $\frac{1}{3}$ of her money for a sealskin cloak, the remainder for a shawl; what did each cost?

4. The loss on a harness sold for \$22.40 was \$8.75. What was the cost?

5. A farmer bought a cow for \$35, and sold her at a gain of $\frac{1}{3}$ of the cost. What was the selling price?

6. If a farmer sell 875 pounds of wool at \$0.35 per pound, and invest the money in cloth at \$0.90 a yard, how many yards will he get?

7. A man bought a cow for \$85, a horse for \$165, and a carriage for \$276. How much more did he pay for the carriage than for the horse and cow?

8. I bought 360 acres of land for \$32,400, and sold it

for \$8,400 more than cost. What was the selling price per acre?

9. If I have \$25.00, and pay all but \$11.50 for cloth at 45 cents a yard, how many yards do I buy?

10. A farmer bought a cow and 254 sheep for \$1,134.50. The cow cost \$67.70. What did 54 sheep cost?

III

1. What should you pay for 18 pecks and 3 quarts of onions, at 48 cents a peck?

2. What cost 75 yards of calico when 9 yards cost \$0.99?

3. At 21 cents each how many boxes of berries can be bought for \$26.25?

4. 6 barrels of flour cost \$58.80. Find the cost of $24\frac{1}{2}$ barrels?

5. How many square feet in a floor 12 ft. by 15 ft.?

6. At \$0.18, how many pounds of veal cost \$1.08?

7. A farmer exchanged 540 bushels of wheat at $67\frac{1}{2}$ cents a bushel, for rye at \$0.45 a bushel. How many bushels did he get?

8. A coal dealer bought 109 tons of coal at \$4.65 per ton, and sold it at \$5.75 per ton. How much was gained?

9. How much added to \$17.54 will make $\$33\frac{1}{4}$?

10. How many pounds of tea at \$0.25, can be bought for 25 doz. eggs at \$0.18 per dozen, and 12 pounds of butter at $\$0.37\frac{1}{2}$ a pound?

IV.

1. What costs 1 pound 4 oz. of cinnamon at \$1.60 a pound ?

2. What is the cost of 16 pieces of cloth, each containing 32 yards at \$1.60 per yard ?

3. What costs $5\frac{3}{4}$ bushels of apples at \$0.20 a peck ?

4. What costs 71 pounds of beef at \$0.11 a pound, 28 pounds of bacon at \$0.16 a pound, and 34 pounds of pork at $12\frac{1}{2}$ cents a pound ?

5. If 12 gallons maple syrup costs \$6.48, what will $7\frac{1}{2}$ gallons cost ?

6. What will $17\frac{1}{2}$ tons of hay cost, when 47 tons cost \$129.25 ?

7. A carpenter earns \$90 a month, and his expenses are \$60 a month. How long will it take him to save \$450 ?

8. How many pounds of coffee at 38 cents a pound, will pay for 2 hogsheads of sugar, containing 1,160 pounds each, at 19 cents a pound ?

9. A man bought two farms, one of 144 acres at \$12 an acre, and the other 108 acres at \$15 an acre. He sold both farms at \$18 an acre. What was the gain per acre ?

10. A grocer sold 9 pounds 8 oz. of tea at 80 cents a pound, and 7 pounds 4 oz. of butter at 32 cents a pound, and took in payment milk at 4 cents a pint. How many gallons did he receive ?

V.

1. At \$1.75 a rod, what will be the cost of one mile of fence ?
2. A farmer sold 75 sheep that cost him \$250 at \$4.25 a head. How much did he make ?
3. A man bought 129 horses at \$128 each and sold them at \$165 each. How much was his entire gain ?
4. A man paid \$22.50 for a harness, and 3 times as much for a cart. How much did both cost ?
5. A man, who earns \$24 a week and spends \$17 a week, will save \$245 in how many weeks ?
6. What will 2 tons and 500 pounds of hay cost, when 5 tons cost \$75 ?
7. Mrs. Jones purchased 48 yards of carpet at \$.37½ a yard, and paid for it with eggs at \$.15 a dozen. How many dozens were required ?
8. If one quart of chestnuts cost 11 cents, how many bushels can be bought for \$13.20 ?
9. How much is gained on 40 bushels of peanuts, bought at \$4 a bushel, and sold at 15 cents a quart ?
10. A farmer bought 26 head of cattle for \$430. He kept them for six months at an expense of \$3 a head per month, and sold them at \$32 each. Did he gain or lose, and how much ?

VI.

1. How many barrels of potatoes at \$2.50 a barrel, will pay for 840 eggs at 25 cts. a dozen ?

2. If 6 pounds of coffee cost \$1.80, how much could you buy for \$3.45?

3. In a train of 26 cars, each car contains 425 bushels of corn. What is the value of the whole at 40 cents a bushel?

4. A farmer exchanged 4 tons of hay at \$10.50 a ton, for 14 cords of wood. What was the price of the wood per cord?

5. A merchant bought 42 yards of broadcloth for \$189. At what price per yard must he sell it to gain \$31.50?

6. A huckster-woman bought 2 bushels of peanuts for \$5.12. At what price per pint must she sell them to double her money?

7. A grocer has 29 pounds 8 oz. of tea that cost him \$10.44. At what price per pound must he sell it to gain \$1.36?

8. I paid \$43.07 for 59 books. At what price must I sell 23 of them to gain \$1.83 on those sold?

9. A farmer exchanged 159 cords of wood at \$5 a cord for a horse, valued at \$144, and the balance in sheep at \$3 a piece. How many sheep did he get?

10. A fruiterer sold 34 boxes of oranges at \$2.75 a box, losing \$54.60. What was the cost of all?

VII.

1. A man having \$406, paid \$30 for clothing, \$75 for board, \$19.75 for books, and a debt of \$203. How much had he left?

2. A horse which cost me \$138, I sold so as to make \$57.63. How much did I receive for it?

3. A dealer sold a carriage for \$391, and made \$74.25. What did it cost him?

4. A man bought a village lot for \$350. After paying \$22.50 taxes and losing \$21 interest, he sold it for \$125.50 more than he paid for it. What was his gain?

5. If 45 laborers are paid \$3,888 for 16 weeks work, how much a day does each receive?

6. What is the difference in the cost of 87 head of cattle at \$37.50 a head and 6,308 sheep at \$5½ a head?

7. The cost of a piece of cloth was \$112.70, and the price \$2.45 a yard. How many yards in the piece?

8. A merchant tailor pays \$3,587 for 211 coats. How much must he sell them apiece to gain \$633?

9. A farmer paid \$3,695 for his farm. After paying \$947 in improvements he sold out for \$4,267. Did he make or lose, and how much?

10. A man bought a boat for \$390; spent \$35 for repairs. He received \$84 for the use of the boat during the time he owned her. He sold out for \$400. How much did he make?

VIII.

1. A stock farmer paid \$500 for a team, \$325 for a flock of sheep, and \$62.50 apiece for 15 cows. How much did his stock cost him?

2. Hattie's father paid \$31.50 for 21 baskets of peaches, and sold each basket for 25 cents more than it cost. How much did he charge a basket?

3. Last season a cheese factory used the milk of 470 cows, and made 690 pounds of cheese per cow. What was the value of the product at $9\frac{1}{2}$ cents a pound?

4. It cost \$850,000 to build 680 miles of telegraph line. How much was that a mile?

5. A merchant bought a piece of broadcloth containing 56 yards for \$133, and sold it at \$3 a yard. How much did he make?

6. A grocer bought 720 pounds of coffee in 60-pound sacks. How many sacks did he buy?

7. A lady having \$120, paid \$58 for a fur cape, and \$3 a yard for 17 yards of silk. How much money had she left?

8. The salary of the President of the U. S. is \$50,000 a year. How much is that per working day of a common year?

9. A dairyman has enough hay to keep his 70 cows 4 months. If he sell 14 cows, how many months will his hay last those left?

10. A farmer's expenses and receipts for 1890 were as follows:

EXPENSES.		RECEIPTS.	
Labor,	\$295.	Butter,	\$419.
Seed,	49.	Oats,	385.
Implements,	136.	Corn,	240.
Family Expenses,	485.	Wool,	176.
Interest Paid,	140.	Pork,	117.
Insurance,	12.	Other Products,	153.

How much money did he make during the year?

IX.

1. How much will it cost to build a railroad 134 miles long at \$65,475 per mile?

2. A merchant bought 150 barrels of flour for \$1,050, and finding 25 barrels of it spoiled sold the remainder at \$7.25 a barrel. How much did he lose?

3. A mechanic receives \$1,200 a year for his labor, and his family expenses are \$668. In what time may he save enough to buy a farm of 56 acres at \$66.50 an acre?

4. A man having \$4,578 paid out all but \$1,642 for 16 horses. What was the cost of each horse?

5. A young man receives a salary of \$25 a week. He pays \$8.75 for board and \$4.65 a week for all other expenses. How much does he save in a year?

6. A gentleman paid \$2,500 for a driving team and carriage. The team cost \$380 more than the carriage. What was the value of the horses?

7. By selling a farm for \$6,749, the owner lost \$2,374. What was its first cost?

8. A dealer sold a quantity of wood to an acid factory for \$2,492, that cost him \$2,024, thus gaining $\$ \frac{1}{2}$ a cord. How many cords did he sell?

9. A speculator bought 140 acres of land for \$7,560, and sold 86 acres of it at \$75 an acre, and the remainder at cost. How much did he make?

10. The receipts and expenditures of a school board for one year were as follows:

RECEIPTS.

EXPENDITURES.

From Collector,	\$4,700.	Salaries of Teachers,	\$5,075.
“ State Moneys,	1,800.	Salary “ Janitor,	480.
“ Interest on bonds,	76.	Expenses for Fuel,	174.
“ Non-resident pupils, 350,		“ Repairs, etc.	340.
		Supplies,	275.

How did the Treasurer's account stand at the close of the year?

X.

1. How many tons of coal at \$5.75 a ton, can be bought for \$230 ?

2. A speculator purchased 600 barrels of flour at \$3.25 a barrel, and sold 200 barrels at \$3.75 per barrel. How much did he make on the lot sold ?

3. When carpet is worth \$4.25 a yard, how much can I buy for \$119 ?

4. A grocer sold 23 barrels of potatoes for \$29.90, and lost 5 cents on the cost of each barrel. What did they cost him per barrel ?

5. How many pounds of butter at 25 cents a pound, should be given for 25 lb. of tea at 49 cents per pound ?

6. What will 2 quarts 1 pint of syrup cost at \$1.04 a gallon ?

7. A grocer bought 10 bushels of beans for \$15.00, and retailed them at \$0.06 $\frac{1}{4}$ a quart. How much did he make on the lot ?

8. How many bushels of potatoes at 95 cents a bushel should be given in exchange for 23 bushels of wheat at \$1.15 a bushel ?

9. A farmer sold 210 bushels of wheat at 96 cents a bushel and bought hay at \$14.40 a ton. He afterwards sold the hay at \$16.25 a ton; what was the gain?

10. A farmer bought of his grocer and paid as follows:

BOUGHT.		PAID.	
16 lb. Coffee	at \$.27½	6 bbl. Potatoes	at \$1.75
20 lb. Starch	at 0.04	½ ton Hay	at 18.00
1 box Soap	at 3.25	1 cd. Wood	at 5.00
28 lb. Sugar	at 0.06¼	208 lb. Butter	at 0.25
5 lb. Tea	at 0.50	28 doz. Eggs	at 0.30
1 bbl. Flour	at 7.25		

How much was due the farmer on the above bill?

XI.

1. Uncle Isaac gave his little niece \$3.68 to divide equally among her 7 brothers and herself. How much did she keep?

2. Mr. Woods paid \$135 for 75 yards of silk, which he sold for \$2.50 a yard. How much did he make?

3. How much should I pay for a quart and a pint of syrup, if 24 gallons cost \$19.20?

4. A stationer bought 15 dozens of Eagle pencils at 30 cents a dozen, and sold them at 4 cents apiece. How much did he gain on all?

5. If 4 ounces of tea cost 15 cents, how many pounds can I buy for \$21.60?

6. A man bought a farm for \$3210, and sold it for $\frac{3}{4}$ of what he paid for it. How much did he get for it?

7. What is the amount of 40 yards of carpet at $\$1\frac{3}{4}$ a yard, and 32 yards of straw matting at 35 cents a yard?

8. A fruiterer had $3\frac{1}{2}$ dozens of cocoanuts in his shop, and bought 75 more. He sold $\frac{3}{4}$ of them for $\$15.60$. How much was that apiece?

9. A stock farmer paid $\$500$ for a horse, $\$325$ less for a flock of sheep, and $\$35$ apiece for 9 cows. How much did all cost him?

10. How much is the amount of the following bill?

12 lb. rice at 8 cents; 6 lb. raisins at 20 cents; $4\frac{1}{2}$ lb. cheese at 15 cents; 15 lb. coffee at $\$.22\frac{1}{2}$; 28 lb. "A" sugar at $6\frac{1}{2}$ cents; $\frac{1}{2}$ dozen cans of beef at 16 cents each.

XII.

1. How many pounds in $\frac{1}{4}$ of a ton of coal, and what would it cost at $\$4.80$ per ton?

2. A man sold a horse for $\$365$, and lost $\$37$. How much did he pay for him?

3. A Western farmer planted 46 acres to corn, and had a yield of 2484 bushels. How much was that per acre?

4. A stock raiser bought 25 head of cattle for $\$625$. He sold $\frac{1}{3}$ of them at one time at $\$35$ each, 10 at $\$30$ each, and the rest at $\$25$ apiece. How much did he gain?

5. A boy bought 5 bu. 3 pk. of peanuts at $\$2.00$ a bushel, and sold them at 5 cents a pint. How much did he gain?

6. Mr. Love paid $\$250$ for a horse, $\frac{1}{3}$ as much for a buggy, and $\$35$ for a harness. What did he pay for all?

7. A grocer has 28 pounds of tea, that cost him \$22.96. How shall he sell it per pound to gain \$5.04 ?

8. A poultry-man paid \$24.84 for 54 hens. How much was that for 2 dozens?

9. A farmer sold 19 tons of hay at \$9½ per ton, and 17 cords of wood at \$3.50 per cord. How much did he get for all?

10. Find the amount of the following bill.

12 New National Fifth Readers,	\$.90
18 Sill's Lessons in English,	.75
84 Peck's G. S. Arithmetic,	.75
18 Steele's Chemistry,	.90
24 Barnes' General History,	\$1.60

XIII.

1. Raymond sold a pair of skates for \$2.75, then earned \$4.75. How much did he lack of having \$9.00?

2. A dealer sold 70 barrels of apples, that cost him \$3.15 per barrel, for \$3.87½. What was his gain on all?

3. At \$2¼ a day, how much would a carpenter earn in 30 days?

4. If 9 hats cost \$22.50, how much would 9 dozens cost at the same rate?

5. A man earns \$3 a day, and pays \$31 a month for expenses. How much may he save during the month of March, 1891, if he work every "week" day?

6. Mr. Logan paid \$17 for a gun, \$12 for a watch, \$67.50 for a bicycle, and sold them so as to make \$26. What did he receive for all?

7. A farmer took 294 bushels of wheat to mill, and had

it made into flour. If each bushel made 43 pounds, how many barrels of flour would he have?

8. A woman sold a butcher 10 chickens at 45 cents each, and with the money bought eggs at 3 cents each. How many dozens did she buy?

9. A farmer sold $37\frac{1}{2}$ tons of hay at \$16 per ton, and as many dollars' worth of wheat at \$1.25 per bushel. How many bushels of wheat did he sell?

10. Find the total of the following bill: 4 lb. of tea at $37\frac{1}{2}$ cents; 16 lb. of sugar at $5\frac{3}{4}$ cents; 5 gallons of syrup at \$.70; 12 lb. of coffee at \$.32; 20 lb. of rice at $6\frac{1}{4}$ cents.

XIV.

1. A farmer sold a turkey for \$1.75, 6 pairs of ducks for $62\frac{1}{2}$ cents each, 3 pairs of chickens for \$1.00 a pair. How much did he get for all?

2. A grocer bought 25 pounds of Java coffee for \$8.25, and sold it at 40 cents a pound. What was his gain?

3. A farmer bought 3 cows for \$70.75, some pigs for \$23.25, and 15 sheep at \$7.50 each. How much did he pay for all?

4. A miller having 75 barrels of flour, sold $\frac{1}{3}$ of it at \$4.75 per barrel. How much did he receive for what he sold?

5. A gallon of maple syrup costs \$1.04. How much is that a pint?

6. A vender sold 8 barrels of potatoes ($2\frac{3}{4}$ bushels each), that cost him \$13.20, at 80 cents a bushel. How much did he make?

7. A horse was bought at a cost of \$175. His owner kept him six months at an expense of \$40.50, and then sold him for \$225. How much did he gain?

8. A merchant bought 40 yards of cassimere at \$2 $\frac{5}{8}$ a yard, and then sold it at \$3.10 a yard. How much did he make on the piece?

9. When flour costs \$5.75 per barrel, how many barrels can be bought for \$1035?

10. Find the amount of the following bill: 2 lb. coffee at 22 $\frac{1}{2}$ cents; 2 $\frac{1}{2}$ lb. tea at 50 cents; 4 lb. codfish at 6 $\frac{1}{4}$ cents; 15 lb. butter at 30 cents; 3 $\frac{3}{4}$ lb. cheese at 20 cents.

XV.

1. At 7 cents a pint, how much molasses can be had for \$4.90?

2. A flour merchant bought 25 barrels of flour for \$112.50, and sold it all for \$137.50. How much did he gain on each barrel?

3. A real estate owner bought a house for \$2925. For how much must he sell it to gain \$525?

4. A grocer bought 46 barrels of flour at \$4.50 a barrel, and sold it all at a gain of \$1.25 per barrel. How much did he receive for it?

5. How much was the profit on 3 barrels of flour, bought at \$4.50 per barrel, and sold at 3 cents a pound?

6. A farmer took a load of oats to market, which weighed 2560 pounds. How many bushels in the load?

7. If 125 pounds of coffee cost \$33.75, how much is that per pound?

8. A man bought a horse for \$150, and sold him so as

to gain $\frac{1}{3}$ of his buying price. How much did he get for him?

9. A miller sold 256 barrels of flour at \$3.40 a barrel, which was \$237.80 more than the wheat from which it was made cost him. What was the cost of the wheat?

10. Find the amount of the following bill: 32 yards of silk at \$1.12 $\frac{1}{2}$; 18 yards of alpaca at \$.87 $\frac{1}{2}$; 42 yards of muslin at 11 $\frac{1}{2}$ cents; 15 pieces of tape at 7 cents; 3 dozen pairs of gloves at \$.37 $\frac{1}{2}$ a pair; 12 pairs stockings at \$.30 a pair; 17 yards of calico at 7 cents.

XVI.

1. If $\frac{3}{4}$ of a barrel of oatmeal is worth \$4.80, what is a barrel worth?

2. If a barrel of flour is worth \$5.60, how much will $\frac{2}{3}$ of a barrel cost?

3. A dealer paid \$29.40 for a 42 gallon cask of syrup, which he sold at \$0.85 per gallon. How much was his profit on the whole quantity?

4. A farmer bought $\frac{3}{4}$ of a barrel of flour at 4 $\frac{1}{2}$ cents a pound. What did it cost him?

5. A stationer buys paper at \$2.40 a ream, and sells it at 20 cents a quire. How much does he make on each ream sold?

6. A man sold a horse for \$125, and received in payment 27 sheep at \$4 per head, the balance in cash. How much money did he receive?

7. A dealer paid \$526.50 for 3 $\frac{1}{2}$ tons of cheese, and sold it at 9 $\frac{1}{2}$ cents a pound. How much did he make on the whole quantity?

8. I bought 32 pounds of beef at 16 $\frac{1}{4}$ cents per pound.

How many pounds could I have bought for the same money, if I had paid 15 cents per pound?

9. A miller bought 350 bushels of wheat at \$1.04 a bushel, and sold the flour and bran for \$539. What was his gain on a bushel?

10. Find the amount of the following bill : 12 yards of calico at $7\frac{1}{2}$ cents; $5\frac{1}{2}$ yards of broadcloth at \$2.50; 15 dozens of buttons at 15 cents; $2\frac{1}{2}$ yards of cassimere at \$1.50; 3 spools of thread at 5 cents; 32 yards of sheeting at $13\frac{3}{4}$ cents.

XVII.

1. A lady had \$325 in her pocket-book. While out shopping, she lost \$87.65 and spent \$28.75. How much had she left?

2. A boy gathers 45 eggs each day, and sells 21 every evening. How many days before he will have 18 dozens?

3. A dealer paid \$182 for a horse. His expenses in taking him to New York City were \$6.25, where he sold him for \$250. What was his gain?

4. At $\$1\frac{1}{2}$ a pound how many pounds of tea can be bought for \$40?

5. A milkman sold a 10-gallon can of milk, each morning and evening during the month of January, at 7 cents a quart. How much money did he receive for the milk?

6. A merchant bought 42 yards of broadcloth for \$189. For how much must he sell it per yard to make \$31.50 on the whole piece?

7. A boy picked 16 quarts of blackberries; after giv-

ing his mother $\frac{3}{8}$ of them, sold the remainder at 4 cents a pint. How much did he receive for them?

8. How many barrels of flour at \$4 a barrel, will pay for 47 hogs at \$14 each, and 54 sheep at \$5 a head?

9. A miller made 241,276 pounds of flour in a week. How many barrels was that?

10. Find the total of the following bill: 75 pounds of tea at 45 cents; 130 pounds of sugar at $6\frac{1}{2}$ cents; 25 pounds of mackerel at 8 cents; 9 gallons of syrup at $62\frac{1}{2}$ cents; 12 pounds of dried beef at $12\frac{1}{2}$ cents; 28 pounds of starch at $4\frac{1}{2}$ cents; 18 pounds of soda crackers at 7 cents.

XVIII.

1. A farmer bought a wagon for \$56.50, and gave in part payment a cow worth \$43.75, and the balance in cash. How much cash did he give?

2. A farmer sold to a family 6 lb. 8 oz. of butter at \$.28 a pound. How much did he get for it?

3. How many dozens of eggs at 25 cents a dozen, can be bought for \$7.25?

4. A farmer bought 308 acres of land at \$16 an acre, and sold the whole for \$5852. How many dollars did he make?

5. A merchant sold a quantity of goods for \$2255 and made \$422.80. What did he pay for the goods?

6. At $12\frac{1}{2}$ cents per pound for maple sugar, how much will 312 pounds cost?

7. A farmer sold 6 bu. 3 pk. of potatoes at 60 cents a bushel. How much did he receive for them?

8. Henry gathered 7 bu. 3 pk. of chestnuts, and sold

them at \$2.40 a bushel. How much did he receive for them?

9. A drover bought a car load of fat cattle containing 32 head for \$800, and sold them all for \$1120. What was his average gain on each?

10. What is the amount of the following: 10 lb. of sugar at \$.06½; 25 lb. of flour at \$.05; 2 lb. 8 oz. of tea at 60 cents a lb.; 2¾ lb. of cheese at \$.20; 37¾ lb. of pork at \$.16; 2 lb. coffee at \$.32.

XIX.

1. A builder bought a car-load of cement for 85 cents a barrel. How many barrels did he buy, if his bill amounted to \$78.20?

2. A man owning 76 acres of land, sold 46 acres at \$19½ per acre, and the balance for \$750. How much did he get for all?

3. At what price per barrel must a lot of 57 barrels of flour, which cost \$228, be sold, so as to make 50 cents a barrel?

4. How much will a merchant make on a piece of broadcloth containing 45 yards, which cost him \$225, if he sells it at \$5.50 a yard?

5. If 4 horse shoes weigh 8 pounds, how many sets can a blacksmith make from 152 pounds of iron?

6. A Long Island farmer raised on an acre of ground 160 barrels of potatoes, which he sold at \$2.25 a barrel. He laid out \$60 for fertilizers, \$50 for labor, \$40 for seed, interest, and other expenses. How much did he make?

7. A merchant having \$135 bought 9 coats, and had \$18 left. What did he pay for each coat?

8. A merchant tailor bought two lots of clothes. The first lot of 144 suits at \$12 a suit, and the second lot of 108 suits at \$15 a suit. He sold all at \$18 a suit. What was his gain?

9. By selling a carriage for \$178, the owner lost \$27. What did it cost at first?

10. Find the amount of the following bill: 1 bbl. molasses, 44 gallons at 45 cents; 50 lb. Carolina rice at 7 cents; 50 lb. of Mocha coffee at 38 cents; 1 bbl. "A" sugar, 328 lbs. at $6\frac{3}{8}$ cents.

XX.

1. A milkman buys milk at 16 cents a gallon, and retails it at 7 cents a quart. What is his gain on 35 gallons?

2. Mrs. Love went shopping with \$60 in her purse. She spent $\frac{1}{3}$ of it for a cloak, \$16.65 for a dress, and \$5.35 for a hat. How much had she left?

3. If I pay \$2.70 for books, \$1.65 for a hat, \$13.50 for a suit of clothes, and \$4.75 for a pair of boots, how much shall I have left from a check of \$27.85?

4. A farmer bought 29 head of cattle for \$928, and sold them at an average gain of \$5 per head. How much did he get for them?

5. A drover bought at one time 207 sheep for \$828, at another time 65 more at \$5 a head. He took them to market at an expense of \$65, and sold them all for \$1500. How much did he make?

6. A provision merchant bought 23 barrels of pork for \$345, and sold it all at a gain of \$92. What did he get a barrel for it?

7. A real estate dealer bought a house for \$2150. After painting and repairing it at an expense of \$365, he sold out for \$2795. How much did he make?

8. A farmer exchanges 40 tons of hay worth \$16.50 a ton, for wheat at \$1.20 per bushel. How many bushels should he receive?

9. A farmer owed a store bill of \$47.86, and paid \$23.74 in cash, the balance in apples at \$2.01 per barrel. How many barrels did it take?

10.

NEW YORK, May 1, 1891.

Mr. D. C. Moore,

Bo't of AUSTIN, NICHOLS & Co.

14	lb. Tea,	\$.65
25	" Starch,	.05 ½
55	" Babbit's Soap,	.06 ½
70	" Coffee,	.22
160	" "A" Sugar,	.04 ⅝
65	" Rice,	.06 ½
40	" Soda Crackers,	.06 ¾
1	doz. Mustard,	.25
2	" Olive Oil,	.60
25	lb. Cheese,	.09 ½
7	lbl. "Good as Gold" Flour,	5.25
28	lb. Raisins,	.24
15	" Currants,	.11 ½
7	doz. Gelatine,	.15

Period	5th.	4th.	3rd.	2nd.	1st.
Name	Trillions.	Billions.	Millions.	Thousands.	Units.
Order of Units	Hundreds Tens Units	Hundreds Tens Units	Hundreds Tens Units	Hundreds Tens Units	Hundreds Tens Units
	DECIMAL POINT.				
	Tenths				
	Hundredths				
	Thousandths				
	Ten-thousandths				
	Hundred-thous'hs				
	Millionths				

The number is read 45 trillion, 370 billion, 36 million, 408 thousand 60, and 123 thousand 456 millionths.

When a decimal is written *without* a whole number, a zero may be put in units place, or it may be left vacant.

Decimal numbers are usually expressed as an integer with a period (.) placed *before* the figure whose unit is *tenths*. This period is called the *decimal sign*.

EXERCISES IN NUMERATION.

I.

Read the following numbers:

1. .5	6. 6.25	11. .04	16. 5.078
2. .06	7. .9	12. .075	17. 8.008
3. .25	8. 5.4	13. .204	18. 0.928
4. .175	9. 25.04	14. .0005	19. 41.002
5. .025	10. .572	15. .00045	20. 6.2040

NOTATION.

Write the following in figures:

1. Nine *tenths*.
2. Twenty-five *hundredths*.
3. Eighty-two *hundredths*.
4. Eighty-two *thousandths*.
5. Three hundred sixty-one *thousandths*.
6. Thirty-six *hundredths*.
7. Seventy-five *ten-thousandths*.
8. Four hundred ninety-six *thousandths*.
9. Three hundred twenty-five *ten-thousandths*.
10. Seven hundred thirty-five *hundred-thousandths*.
11. Five, and five *tenths*.
12. Seven hundred two thousand, and two *hundredths*.
13. Sixty-nine, and seven *ten-thousandths*.

14. Six hundred twenty-five *hundred-thousandths*.
15. One hundred, and one *thousandth*.
16. Nine hundred, and sixteen *ten-thousandths*.
17. One thousand, and one *hundred-thousandths*.
18. Four hundred ninety-six *thousandths*.
19. Ninety-nine thousand, and seven *millionths*.
20. Twenty, and twenty-four *ten-millionths*.

II.

Write the following another way :

- | | | | |
|--------------------|--------------------|------------------------|-------------------------|
| 1. $\frac{3}{10}$ | 6. $7\frac{2}{10}$ | 11. $7\frac{7}{10}$ | 16. $6\frac{17}{100}$ |
| 2. $\frac{15}{10}$ | 7. $5\frac{3}{10}$ | 12. $7\frac{1}{2}$ | 17. $12\frac{35}{100}$ |
| 3. $\frac{7}{10}$ | 8. $6\frac{5}{10}$ | 13. $4\frac{5}{100}$ | 18. $4\frac{1}{100}$ |
| 4. $\frac{8}{10}$ | 9. $6\frac{1}{2}$ | 14. $16\frac{7}{100}$ | 19. $17\frac{28}{100}$ |
| 5. $3\frac{7}{10}$ | 10. $5\frac{1}{2}$ | 15. $12\frac{14}{100}$ | 20. $1\frac{126}{1000}$ |

III.

- | | | | |
|------------------|-------------------|--------------------|-----------------------|
| 1. $\frac{1}{2}$ | 6. $\frac{3}{4}$ | 11. $\frac{4}{5}$ | 16. $\frac{1}{3}$ |
| 2. $\frac{1}{3}$ | 7. $\frac{2}{3}$ | 12. $\frac{7}{8}$ | 17. $\frac{2}{3}$ |
| 3. $\frac{3}{8}$ | 8. $\frac{1}{4}$ | 13. $7\frac{1}{2}$ | 18. $12\frac{5}{8}$ |
| 4. $\frac{5}{8}$ | 9. $\frac{1}{8}$ | 14. $8\frac{3}{4}$ | 19. $10\frac{3}{8}$ |
| 5. $\frac{1}{4}$ | 10. $\frac{3}{8}$ | 15. $9\frac{3}{8}$ | 20. $17\frac{3}{100}$ |

IV.

Change to common fractional forms :

- | | | | |
|--------|----------|----------|-----------|
| 1. .5 | 6. .875 | 11. .40 | 16. .032 |
| 2. .6 | 7. .48 | 12. .60 | 17. .36 |
| 3. .8 | 8. 6.48 | 13. .125 | 18. .625 |
| 4. .25 | 9. 6.25 | 14. .375 | 19. 2.625 |
| 5. .75 | 10. .075 | 15. .625 | 20. .9375 |

NOTE:—After Lesson V. pupils will use the numbers in the 1st and 3d columns as multipliers for the 2d and 4th columns of Lessons II., III. and IV., for practice in multiplication of decimals.

V.

1. Add 0.625, 243.005, .901, $375.0\frac{1}{2}$, $\frac{3}{4}$, .375, and 7.250.
2. From ten, and 25 *hundredths*, take six *millionths*.
3. Add 0.875, 281.25, 15.625, $\frac{3}{8}$, .0625, $62.0\frac{1}{2}$, and .032.
4. From two hundred six *hundredths*, take two hundred six *thousandths*.
5. Add 10 thousand and 1 *millionth*, 400 *thousandths*, 96 *hundredths*, 47 *millionths*, 60 thousand and 8 *millionths*.
6. Add 15 and 19 *hundredths*, 7 and 4 *tenths*, 64 and 437 *thousandths*, and 485 *ten-thousandths*.
7. From 83 and 75 *hundredths*, take 64 and 3,275 *millionths*.
8. From 475 and 75 *hundredths*, take 99 and 88 *hundredths*.
9. Add \$63.75, \$9.60, $7\frac{1}{2}$ cents, \$.80, $\$4\frac{1}{2}$, \$.375, \$84.625, $\$3\frac{1}{4}$.
10. Add 271 *thousandths*, 185 *ten-thousandths*, 477 *millionths*, 16 and 4896 *hundred-thousandths*, and 96 *ten-millionths*.

VI.

Multiply and Divide.

1. 28.8 by $4\frac{1}{2}$.
2. 95.16 by $.78$.
3. 8.375 by $6\frac{1}{4}$.
4. 10.75 by 12.5 .
5. $\frac{5}{8}$ by 2.5 .
6. $70\frac{1}{4}$ by 7.5 .
7. $1\frac{1}{8}$ by $.65$.
8. $156\frac{1}{4}$ by $.625$.
9. $84\frac{3}{8}$ by $4\frac{1}{2}$.
10. $45\frac{5}{8}$ by 12.5 .

Divide.

1. 1.776 by $.24$.
2. 31.25 by $12\frac{1}{2}$.
3. 31.39 by $.43$.
4. $45\frac{5}{8}$ by $.125$.
5. 15.625 by $31\frac{1}{4}$.
6. 8.152 by $\frac{4}{5}$.
7. 31.27 by 125.08 .
8. 871.88 by 24.56 .
9. 97.524 by $.1806$.
10. 1.603 by 2.564 .

VII.

Multiply.

1. 6.4 by 1.5.
2. 0.64 by 0.15.
3. 0.09 by 0.0016.
4. 0.427 by 345.
5. 0.036 by 7.49.
6. 53.4 by 97.0.
7. .0069 by 95.6.
8. 76.541 by 7.32.
9. 0.076 by 8.05.
10. 42.5 by .625.

Divide.

1. 38.4 by 12.
2. 82.32 by 2.1.
3. .58961 by .07.
4. 0.429 by 0.35.
5. 4.563 by 0.027.
6. 70.18 by 24.2.
7. 185.25 by 0.075.
8. 268.4 by .044.
9. 14,506.8 by 840.
10. 670.08 by .0160.

VIII.

1. A bookseller paid \$183.75 for 35 books. Find the price of 17 books.

2. How many lambs at \$3.65, can you buy for \$95?

3. If 12.5 tons of hay cost \$71.25, what will 3 tons cost?

4. What will 5 quarts of strawberries cost at the rate of \$0.93 $\frac{3}{4}$ for 15 quarts?

5. What will 75.125 acres of land cost at \$70.50 an acre?

6. What will be the cost of 75 pounds of sugar at 8 $\frac{3}{4}$ cents per pound?

7. If 11.5 acres of land cost \$735.25, what will be the cost of an acre?

8. What will be the cost of 9 $\frac{3}{4}$ miles of railroad at \$45,675.375 a mile?

9. From a vat containing 3465 gallons of vinegar, 75.25 barrels of $31\frac{1}{2}$ gallons each were drawn. How many gallons remained?

10. A farmer paid \$2,896.87 $\frac{1}{2}$ for land, and sold 56.25 acres of it at \$31 an acre; the remainder was worth \$20.50 an acre. How many acres did he buy?

IX.

1. A farmer sold $7\frac{1}{2}$ acres of land for \$70.12 $\frac{1}{2}$. How much did he get per acre?

2. What is the quotient of $16\frac{3}{4}$ divided by 12.5?

3. How many yards of calico at \$.07 $\frac{3}{4}$ per yard can be bought for \$9.25?

4. A man paid \$40.50 for a range of wood at the rate of \$3.37 $\frac{1}{2}$ per cord. How many cords in the range?

5. If a family pay \$47.31 $\frac{1}{4}$ for five weeks provisions, how much is that a week?

6. At 34 cents a bushel, how many barrels of apples can be had for \$13.60, allowing $2\frac{1}{2}$ bushels to the barrel?

7. If 75.875 bushels of wheat cost \$131.25, how much will $9\frac{1}{4}$ bushels cost?

8. A miller bought 26 yards of cloth at \$4.37 $\frac{1}{2}$ a yard, and paid for it in flour at \$7.25 a barrel. How many barrels of flour did it take to balance the account?

9. A farmer sells 3 cows at \$50 each, a yoke of oxen for \$120, and takes in payment 60 sheep. How much do the sheep cost him per head?

10. NEW YORK, May 31, 1890.
Jas. Rowland,

Bo't of BENJ. WAKEMAN & Co.
16 lb. tea at \$.85; 18 lb. coffee at \$.27 $\frac{1}{2}$; 13 lb. rice

at \$.09½; 2 boxes of raisins at \$.95; 1 kit mackerel, \$3.75; ½ bbl. "A" sugar, 130 lbs. at \$.06¾. Put this in bill form and give the amount.

X.

1. What cost $42\frac{3}{4}$ pounds of tea at \$.68¾ a pound?
2. If 17 pounds of tea cost \$12.37½, what will 10 pounds cost?
3. A grocer sold 12.75 pounds of butter for \$2.93¼. How much was that a pound?
4. What is the value of 84 bales of cotton, containing $425\frac{1}{2}$ pounds each, at 28 cents a pound?
5. A farmer exchanges 9 tons of hay, worth \$16.87½ a ton, for oats at $52\frac{1}{2}$ cents a bushel. How many bushels should he receive?
6. A farmer buys 23.25 yards of cloth at \$3.75 a yard. If he pay for it in butter at 75 cents a pound, how much butter would it take to pay for the cloth?
7. How many pounds of butter could be made from 46 cows, during the month of June, each cow averaging 2.5 gallons of milk daily, and each gallon making .5 pound of butter?
8. A man bought a farm of 148 acres at \$67 per acre. He paid \$7,850 in cash, 19 head of cattle at \$35 a head. How much remained unpaid?
9. If ¾ of a yard of cloth cost \$2.40, how many yards can be bought for \$19.20?
10. What will 12 cwt. of hay cost at \$18.75 per ton?

MEASURES.

I.

1. *How much hay at \$8 per ton can be bought for \$32?*
 2. *If a yard of crape cost \$.40, what will 9 yards cost?*
 3. *At 48 cents a bushel what will 128 lbs. of oats cost?*
 4. *What will 2.5 dozen eggs cost at 18 cents a dozen?*
 5. *If 8 chickens are worth \$4, how much are they worth apiece?*
-

1. How much hay at \$10 a ton, can be bought for \$42.50?

2. A grocer bought pork at \$16 a barrel, and retailed it at \$10 a hundred-weight. How much money did he make on 15 barrels?

3. How much will $1\frac{1}{4}$ hundred-weight of flour cost at \$5.88 a barrel?

4. How much will 2 barrels of beef cost at 15 cents a pound?

5. At 64 cents a bushel, what will 200 pounds of oats cost?

6. What will 3 hundred-weight of pork cost at $9\frac{1}{2}$ cents a pound?

7. How much will a farmer receive for 4 T. 5 cwt. of hay at \$15 a ton?

8. A grocer buys a barrel of pork for \$19, and sells it at $12\frac{1}{2}$ cents a pound. Find his profit.

9. How much will 925 pounds of corn meal cost at \$1.20 per hundred-weight?

10. A barrel of flour which costs \$9.75, is retailed at $6\frac{1}{4}$ cents a pound. How much is gained?

II.

1. Richard Dawson sold a village lot for \$30, which was 20% of what it cost him. How much money did he lose in the transaction?

2. I bought 7 tons of coal at \$4.50 per ton, and gave the dealer 2 twenty-dollar bills. How much change should I receive back?

3. How many dozen pint bottles will be needed to hold 5 gal. 2 qt. of blackberry wine?

4. If 2 bushels of potatoes cost \$1.50, what will be the cost of 3.5 bushels?

5. At 50 cents a bushel, how many bushels of apples can be bought for \$9?

1. What will 1 lb. 4 oz. of pork cost at 16 cents a pound?

2. What is the price of 3 quarts of sweet potatoes, if 2 pk. 6 qt. cost 154 cents?

3. How much will $\frac{1}{2}$ gross, and $\frac{1}{2}$ dozen pens cost at 48 cents a gross?

4. When eggs are worth 36 cents a dozen, what will a score and $\frac{1}{4}$ dozen cost?

5. At 2 cents a foot, what is the cost of fencing both sides of a railroad track, 20 yards in length?

6. What will 2 lb. 6 oz. of butter cost at 40 cents a pound?

7. A farmer having 6 bushels of strawberries, desires to put them in $\frac{3}{4}$ quart boxes. How many boxes will be required to hold them?

8. A stationer bought a gross of pens for 72 cents, and sold them at a cent each. How much did he make on the gross?

9. When eggs are sold at the rate of 10 for \$.25, what will 2 dozens cost?

10. If a boy can walk 6 miles in 2 hours, how far can he walk in 40 minutes?

III.

1. If 1 pound of butter cost 28 cents, what will 2 lb. 12 oz. cost?

2. When 4 bushels of pears can be bought for \$4.80, how much can be purchased for \$2.50?

3. At \$0.50 a pound for tea, how much will .4 of a pound cost?

4. How much must be paid for 4 pairs of shoes at \$2.5 a pair?

5. At 12.5 cents a pound, what will 32 pounds of sugar cost?

1. At 5 cents a gill, what will 2 pints 2 gills of maple syrup cost?

2. At $2\frac{1}{2}$ cents an ounce what will $1\frac{1}{4}$ pounds of cinnamon cost?

3. If peanuts are sold at 10 cents a pint, how much is made on the sale of $1\frac{1}{2}$ bushels that cost \$4.80 per bushel?

4. A dealer bought apples at the rate of $\frac{3}{4}$ of a peck for 30 cents, and sold them at 7 cents a quart. How much did he make on $2\frac{1}{4}$ bushels?

5. What will 18 gal. 3 qt. of vinegar cost at 20 cents a gallon?
6. At 4 cents a pint, what will 3 gal. 3 qt. of milk cost?
7. At 5 cents an ounce what will $3\frac{1}{2}$ pounds of licorice cost?
8. My pony is 13 hands high, how many feet is that?
9. What will $2\frac{7}{8}$ pecks of plums cost at 5 cents a quart?
10. At a county fair a boy sold $\frac{3}{4}$ bushel of chestnuts for \$3.84. What was that a pint?

IV.

1. What will be the cost of a gold chain weighing 2 ounces at \$1.25 a pennyweight?
 2. At 12 cents a yard, what will 4.25 yards of ribbon cost?
 3. What will 10.5 dozen eggs cost at 18 cents a dozen?
 4. If a bushel of apples is worth fifty cents, what are 2.5 bushels worth?
 5. At \$60 an acre, what will 3.75 of an acre of land cost?
-
1. I have a silver ring which weighs 10 pennyweights. What is it worth, if silver is selling for \$1.12 an ounce?
 2. If $\frac{1}{2}$ an ounce of tea costs $\frac{1}{4}$ cent, what will 2 pounds, 4 ounces cost?
 3. At one cent a pound, how many tons of iron can be bought for \$30?
 4. How many bottles, holding $\frac{1}{2}$ pint each, can be filled from $2\frac{3}{8}$ gallons?
 5. A fruit dealer paid \$8 for 3 bu. 3 pk. of pears, and sold them at 75 cents a peck. What was his gain?

6. How much will 3 oz. 6 pwt. of gold dust cost at \$.75 a pennyweight?

7. What will 25 barrels of flour cost at $4\frac{1}{2}$ cents a pound?

8. If a bushel of wheat weighs 60 pounds, what will 3660 pounds cost at \$1.20 per bushel?

9. At 2 cents a pound how many tons of iron can be bought for \$792.36?

10. Find the total weight in pounds of 3 tons of hay, 2 tons of straw, 24 ounces of gold, 32 ounces of lead, 1 barrel each of beef, pork, and flour, 3 hundred-weight of meal, and 75 pounds of flour?

V.

1. At 3.5 cents a foot, what will 8 yards of wire cost?

2. If .5 yard of cloth cost \$.50, how much will 1.6 yards cost?

3. Frank paid \$.75 for a pair of gloves, and .5 of a dollar for a slate. How much did he pay for both?

4. How many feet high is a pony that measures 13.5 hands?

5. At seven-eighths of a dollar per bushel, how many bushels of potatoes can be purchased for \$16?

1. If 3 quarts of nuts cost 21 cents, how much would be made by selling 3 pecks at 5 cents a pint?

2. A merchant bought 40 gallons of syrup for \$12, and sold it at the rate of 15 cents for $1\frac{1}{2}$ quarts. What was his entire gain?

3. If a bushel of peas cost \$1.28, how much will $\frac{3}{4}$ of a peck cost?

4. How much will a 40 quart can of milk cost at 25 cents a gallon?

5. If 2 pounds of steel cost $\frac{1}{2}$ dime, what will .5 of a ton, and $\frac{1}{2}$ hundred-weight cost?

6. Find the value of 21 crates of strawberries, each containing 14 quarts, at 18 cents a quart?

7. At \$0.64 a bushel, what would 16 bushels $3\frac{1}{4}$ pecks of oats cost?

8. A grocer bought a hogshead of molasses for \$31.50. At what price per gallon must he sell it to make 25 cents on each gallon?

9. A man bought 3 bushels of chestnuts, paying at the rate of 7 cents a quart, and retailed them so as to gain \$2.88 on the whole. What was his selling price a quart?

10. The gross weight of a package of butter was 27 lb. 12 oz., and the pail containing it weighed 5 lb. 4 oz. What was the value of the butter at 25 cents a pound?

VI.

1. If 1 quart of nuts cost 8 cents, how many bushels can be bought for \$3.20?

2. How many half-pints can be filled from a gallon of milk?

3. If 7 pineapples cost \$.70, what will 1 dozen cost?

4. If 1 pound of cheese cost 16 cents, what will 5.5 pounds cost?

5. The pupils of our school collected 16.5 bushels of potatoes, and divided them equally among 4 poor families. How much did each family receive?

1. If a grocer buys a barrel of vinegar for \$5, and sells it at 20 cents a gallon, what will he gain?

2. At 5 cents a quart, how much will $\frac{3}{4}$ bushel of beans cost?

3. A farmer had 500 bushels of potatoes, which he wished to put into barrels, holding $2\frac{1}{2}$ bushels. How many barrels will be required?

4. If I take 2 quarts of milk each day, during the month of February, 1891, what will be the cost at 10 cents a quart?

5. A fruit-dealer bought $1\frac{1}{4}$ bushels of huckleberries at 60 cents a peck, and sold them at 10 cents a quart. How much did he gain on the berries?

6. A merchant paid \$47.50 for a barrel ($31\frac{1}{2}$ gal.) of molasses, but $4\frac{1}{2}$ gallons leaked out. At what price per gallon must he sell the remainder to gain \$6.50?

7. A marketman bought 50 bushels of beans at \$1.25 a bushel, and sold them at $\$0.06\frac{1}{4}$ a quart. How much was his gain?

8. A farmer having 547 bushels and 1 peck of potatoes wishes to put them into barrels, holding 2 bushels 3 pecks. How many barrels will be required to hold them?

9. A boy sold six pails of berries, each containing .5 of a peck at $12\frac{1}{2}$ cents a quart. How much did he receive for them?

10. If a family use 2 quarts of milk a day, what is the cost of milk for them during a leap year, if milk is 24 cents a gallon?

VII.

1. What will .5 of a barrel of pork cost at 10 cents a pound?

2. If 1 barrel of flour cost \$7.84, what would be the cost of 49 pounds?

3. In 5 and four-fifths tons of cheese how many pounds?

4. *What is the value of 1800 pounds of wheat at \$1.50 a bushel?*

5. *In a dozen, a score, and a gross, how many marbles?*

1. What will $1\frac{1}{4}$ barrels of pork cost at 10 cents a pound?

2. What will 13.75 barrels of rye flour cost at \$9.80 per barrel?

3. How much will it cost to transport 10 T. 15 cwt. of steel rails from New York to Chicago at $\frac{1}{4}$ cent a pound?

4. The Hudson River, off Nyack is $3\frac{1}{2}$ fathoms deep. What is the depth in feet?

5. If you pay 6 cents for 2 feet of wire, how much would you pay for 20 yards and 2 feet?

6. What will $\frac{1}{3}$ of a pound of candy cost at $1\frac{1}{2}$ cents an ounce?

7. A farmer sold $\frac{1}{4}$ of a ton of hay at 70 cents a hundred-weight. How much did he receive for the hay?

8. The East River, off Whitestone Point, is 54 feet deep. What is the depth in fathoms?

9. What will $13\frac{1}{8}$ yards of ribbon cost at 8 cents a foot?

10. A grocer bought 3 barrels of flour at \$6 per barrel, and retailed one-half of it at 4 cents a pound. How much did he gain on the part sold?

VIII.

1. *What will be the cost of building a wire fence 1 mile in length at \$.25 per rod?*

2. *A farmer paid \$25 for a cow, which was .4 of what he paid for a horse. What was the cost of both?*

3. When apples are worth 60 cents a bushel, what will 2 bushels 3 pecks cost?

4. Find the cost of fencing a field 16 rods long and 10 rods wide at \$1.25 per rod.

5. How many pounds remain in a barrel of flour after one-fourth of it has been used?

1. How much will it cost to fence both sides of a road 20 rods long at $\$ \frac{1}{2}$ a rod?

2. The tire on my wheelbarrow, before it was welded and put on the wheel, was 6 feet long. How many times will this wheel turn in going 300 feet?

3. What will $\frac{1}{2}$ mile of fence cost at 50 cents a rod?

4. What will it cost to fence my garden, which is 4 rods wide and 10 rods long at \$1.25 a rod?

5. If a rail is $16\frac{1}{2}$ feet long, how many rails will lay a railroad track $1\frac{1}{2}$ miles in length?

6. What will it cost to build a half-mile of road at \$2.75 per rod?

7. A carriage wheel in turning around once passes over $16\frac{1}{2}$ feet of space. How many times will it revolve in running 21 miles?

8. If the Atlantic cable is 3500 miles in length, and cost 20 cents a foot to lay it, what was the entire cost?

9. A ploughman on a western prairie turns a furrow 9 inches wide and 160 rods long in a straight line. How many miles will he walk in ploughing a strip of land 18 feet wide?

10. Find the total length in feet of 180 rods; 35 feet; 7 yards; $3\frac{1}{2}$ miles; 55 inches; 16 hands; $8\frac{1}{2}$ fathoms; 4 spans; 210 paces; 16 knots.

IX.

1. In a board 12 feet long and 1.5 feet wide, how many square feet?

2. What is the cost of building a fence around a section of land at 50 cents a rod?

3. How many acres of land in a lot 20 rods long and 16 rods wide?

4. How many surface feet in a block of marble 3 feet long and 2 feet thick?

5. At 12 cents a pint, how much maple syrup can be bought for \$4.26?

1. What will a piece of ribbon 42 feet long cost at 20 cents a yard?

2. How many boards 12 inches wide and 10 feet long will be required to build a fence 5 feet high around my lot which is 50 feet by 100 feet?

3. At $\$ \frac{1}{2}$ a foot, what is the cost of 2 rods and $2\frac{1}{3}$ yards of fencing?

4. I have 4 village lots, each 50 feet by 150 feet, all lying in one plot. How many feet of fence will be required to inclose the plot?

5. A lad steps 2 feet at a time, how many steps will he take in going around my garden which is 2 rods wide and 100 feet long?

6. A military company marching at the rate of 4 miles an hour takes 128 steps in a minute. What is the length of each step?

7. A man takes 880 steps, of 3 feet each, to walk around a square field. How many rods long is each side?

8. A gentleman's horse travelled $7\frac{1}{2}$ miles in $37\frac{1}{2}$ minutes. How far did the horse travel in an hour?

9. How many boards 13 feet long and 9 inches wide will be required to build a fence 13 feet high and one mile long?

10. I have a rectangular farm, 160 rods long and 120 rods wide, around which I desire to put a barbed-wire fence at a cost of $16\frac{1}{2}$ cents a rod. I also wish to divide it into four equal lots, the length of each lot to be 120 rods. What will be the cost of the entire fence?

X.

1. A gross of pens, which cost 48 cents was sold at the rate of 2 for one cent. What was made on the entire gross?

2. A stationer bought legal-cap paper for \$2.40 per ream and retailed it at \$.25 a quire. How much did he make on each ream?

3. Find the cost of .75 of a bushel of nuts at 5 cents a pint.

4. How many days in the summer months?

5. A grocer bought 2 barrels of pork for \$32 and retailed it at 10 cents a pound. How much was his gain?

1. If 2 pens cost 3 cents, what will $\frac{1}{3}$ of a gross cost?

2. My uncle John is 3 score years of age. I am 25 years of age. How much older is my uncle than I?

3. I bought a ream of legal-cap paper for \$2.40, and sold it at 20 cents a quire. What was my entire gain?

4. How many screws in $1\frac{1}{4}$ gross and $1\frac{1}{4}$ dozen?

5. How much will be the cost of 1 bushel 1 peck 1 quart 1 pint of clover seed at \$3.20 a bushel?

6. A stationer bought a gross of Gillot pens, No. 604,

for 72 cents, and retailed them at the rate of 3 pens for 2 cents. What did he make on the gross?

7. From $\frac{3}{4}$ of a score take the difference between .2 of a hundred and $\frac{3}{4}$ of a dozen.

8. How many days from March 16, 1889, until October 4, 1889?

9. I bought 2 reams of paper at \$2.40 a ream, and sold it at 15 cents a quire. What did I make?

10. If it takes 8 screws to fasten a school desk to the floor, how many desks could be fastened with 4 gross of screws?

PRACTICAL MEASURES.

Currency is applied to money which may be legally offered in the payment of debts. Money is the measure of value. **United States Money** (\$. U. S.) consists of Coin and Paper Money. Coin is called Specie. **Gold Coins** are the eagle (\$20), the half-eagle (\$10), the quarter-eagle (\$5). **Silver Coins** are the dollar (\$1.00), half-dollar (\$.50), quarter dollar (\$.25), the dime (\$.10). The nickel; the bronze. The standard unit is the gold dollar; 25.8 grains. The trade-dollar weighs 420 grains, but is not in use. The new dollar of 1878, contains $412\frac{1}{2}$ grains of silver.

Sterling Money is applied to the legal currency of Great Britain. The **pound** or **sovereign** is 20 shillings and worth \$4.86 U. S. A **guinea** is equal to 21 shillings, or \$5.11 U. S. The **crown** is one quarter of a pound (£), or 5 shillings. The **franc** of France, is worth about $19\frac{1}{2}$ cents. The **mark** of Germany is equal to $23\frac{1}{2}$ cents.

1. **Avoirdupois Weight.** 1 Ton equals twenty hundred weight, or 2,000 pounds, 1 pound equals 16 ounces, a barrel of flour weighs 196 pounds, a barrel of beef or pork weighs 200 pounds, a keg of nails 100 pounds, a bushel of potatoes 70 pounds, a bushel of oats 32 pounds, a bushel of wheat weighs 60 pounds. Buckwheat weighs 42 pounds to the bushel.

2. **Troy Weight** is used for weighing the precious metals, and minerals. 12 ounces, (oz.) equal 1 pound, 20 pennyweights, (pwt.) equal 1 oz., 24 grains, (gr.) equal 1 pwt.

3. **Apothecaries Weight** is used in *compounding* and *mixing* medicines. 12 ounces (oz.) equal 1 pound, (lb.) 8 drams (dr.) equal 1 oz., 3 scruples (sc.) equal 1 dram, 20 grain (gr.) equal 1 scruple.

4. **Liquid Measure.** There are 4 gills in a pint, 2 pints in a quart, 4 quarts in a gallon, and $31\frac{1}{2}$ gallons in a barrel. The quart in this measure is about $\frac{1}{6}$ less than the quart in dry measure. The liquid gallon contains 231 cubic inches.

5. **Dry Measure.** This measure is in use somewhat among farmers and others, but most articles of food are now sold by weight. There are 8 quarts in a peck, and 4 pecks in a bushel. There are 2,150.4 cubic inches in a bushel.

6. **Linear Measure** is used in measuring lengths, breadths, depths, heights, or distances. One mile is equal to 320 rods, or 1760 yards, or 5280 feet. One rod is equal to $5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet. In a foot there are 12 inches, and 3 feet in a yard. A hand is 4 inches, a fathom is 6 feet, a span is 9 inches, a pace is 3 feet. A knot is a nautical mile, $1\frac{1}{4}$ common mile.

7. Surveyor's Measure. The unit of measurement is the chain,—4 rods or 66 feet long, containing 100 links. It is used in laying out roads, and measuring the boundaries of land.

8. Square Measure is used in measuring surfaces, such as land, boards, plastering, painting, etc. There are 144 square inches in a square foot, 9 square feet in a square yard. 160 square rods of land equal 1 acre.

9. Cubic Measure is used in computing length, breadth, and thickness, as volume or space. 1728 cubic inches equal 1 cubic foot, 27 cubic feet equal 1 cubic yard, 128 cubic feet equal 1 cord,—which is a pile of wood or stone 8 feet long, 4 feet wide, and 4 feet high.

Time is a limited portion of duration. The day is the *Standard Unit*.

60 sec. = 1 min.	52 wk. and 1 da. or	} = 1 yr.
60 min. = 1 hr.	365 da.	
24 hr. = 1 da.	366 da. = 1 Leap year.	
7 da. = 1 wk.	100 yr. = 1 Century.	

The **Civil Year** is divided into twelve Calendar months, thus:

January (Jan.)	1st mo.	31 da.	July (July)	7th mo.	31 da.
February (Feb.)	2d mo.	28 da.	August (Aug.)	8th mo.	31 da.
March (Mar.)	3d mo.	31 da.	September (Sep.)	9th mo.	30 da.
April (Apr.)	4th mo.	30 da.	October (Oct.)	10th mo.	31 da.
May (May)	5th mo.	31 da.	Nov. (Nov.)	11th mo.	30 da.
June (June)	6th mo.	30 da.	Decemb'r (Dec.)	12th mo.	31 da.

In most business transactions, 30 days are counted as a month, and 12 months a year.

"Thirty days hath September,
 April, June, and November;
 February twenty-eight alone,
 All the rest have thirty-one;
 Except in Leap year, then is the time
 When February has twenty-nine."

Every year, which is exactly divisible by 4, and *not* by 100 is a **leap year**.

A Solar Year, or the time of one revolution of the earth around the sun, is 365 da. 5 hr. 48 min. 49.62 sec.

CIRCULAR MEASURE.

The measures used in measuring angles and the arcs of circles are the *circle* (**cir.**), the *degree* ($^{\circ}$), the *minute* ($'$), and the *second* ($''$).

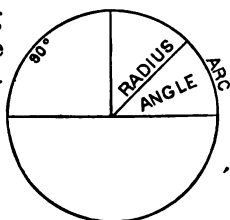


TABLE.

$60'' = 1'$. $60' = 1^{\circ}$. $360^{\circ} = 1$ **cir.**

Angular or Circular Measure is used in measuring angles, determining latitude and longitude, etc.

Miscellaneous. There are 12 units in a dozen, and 20 in a score. A pair is two things, a "set," six things. A gross is 144 units, or 12 dozens. A ream of paper contains 480 sheets, or 20 quires.

FRACTIONS.

INDUCTIVE EXERCISES AND BUSINESS PROBLEMS.

I.

NOTE.—Only the numerators of fractions having like denominators can be added. When the denominators are not alike, make them so by *inspection*. In adding where there are more than two fractions, add the first two, then their sum to the other fraction. Do not use pen or pencil in oral exercises, excepting to give answers. Always find the least common denominator by inspection, when possible.

1. What cost 2 rods of wire fence at 10 cents a foot?
2. The top of your school desk is 2 feet long and 18 inches wide. How many yards around it?
3. If 1 ounce of coffee cost 1 cent, what will $1\frac{1}{4}$ of a pound cost?
4. What will 4 lb. 7 oz. of cheese cost at 16 cents a pound?
5. What will 2 dozens blank books cost at $33\frac{1}{2}$ cents each?

- | | | |
|---|--------------------------------------|---------------------------------------|
| 1. $\frac{3}{8} + \frac{7}{8} =$ what? | $\frac{5}{8} + \frac{7}{8} =$ what? | $\frac{2}{8} + \frac{7}{8} =$ what? |
| 2. $\frac{7}{8} + \frac{9}{8} =$ what? | $\frac{11}{8} + \frac{7}{8} =$ what? | $\frac{8}{8} - \frac{1}{8} =$ what? |
| 3. $\frac{5}{8} - \frac{1}{8} =$ what? | $\frac{7}{8} - \frac{1}{8} =$ what? | $\frac{11}{8} - \frac{1}{8} =$ what? |
| 4. $\frac{4}{8} - \frac{1}{8} =$ what? | $\frac{11}{8} + \frac{5}{8} =$ what? | $\frac{7}{8} - \frac{1}{8} =$ what? |
| 5. $\frac{11}{8} + \frac{1}{8} =$ what? | $\frac{7}{8} - \frac{3}{8} =$ what? | $\frac{1}{8} - \frac{1}{8} =$ what? |
| 6. $\frac{4}{8} + \frac{5}{8} =$ what? | $\frac{3}{8} - \frac{1}{8} =$ what? | $\frac{4}{8} + 1\frac{1}{8} =$ what? |
| 7. $\frac{8}{8} + \frac{4}{8} =$ what? | $\frac{11}{8} - \frac{1}{8} =$ what? | $\frac{1}{8} - \frac{3}{8} =$ what? |
| 8. $4\frac{1}{8} - \frac{1}{8} =$ what? | $\frac{8}{8} + \frac{5}{8} =$ what? | $7\frac{1}{8} - 3\frac{1}{8} =$ what? |
| 9. $14\frac{1}{8} + 6\frac{7}{8} =$ what? | $2\frac{7}{8} + \frac{7}{8} =$ what? | $4 - \frac{7}{8} =$ what? |
| 10. $\frac{7}{8} + 2\frac{3}{8} =$ what? | $6 - 4\frac{7}{8} =$ what? | $7\frac{1}{8} - \frac{1}{8} =$ what? |

II.

1. What cost 3 pecks 3 quarts of potatoes at 16 cents per half peck?

2. At 50 cents a hundred-weight, how much will $\frac{1}{2}$ of a ton of hay cost?

3. What will be the cost of 1 quart $1\frac{1}{2}$ pint of molasses at 60 cents a gallon?

4. How much will the case of a gold watch cost which weighs $1\frac{1}{2}$ ounces at \$1.50 per pennyweight, allowing \$5.00 for making?

5. I buy 2 bushels of walnuts at \$2 a bushel, and sell them at 10 cents a quart. What is my gain?

1. Mary paid \$0.75 for a sled, and \$3 for a pair of shoes. How much did she pay for both?

2. Henry gave $\$3\frac{3}{8}$ for a book, \$0.25 for a slate, and $\$1\frac{1}{3}$ for an inkstand. How much did he pay for all?

3. John's mother gave him $\$3\frac{3}{4}$; he spent $\$1\frac{1}{3}$ for a necktie. How much money had he left?

4. A gentleman who owned a sailboat sold $\frac{1}{8}$ of it to a friend. What part did he still own?

5. A boy had $\$3\frac{3}{4}$, and earned \$2 $\frac{1}{2}$. How much had he then?

6. What cost 4 bushels 3 pecks of oats at 10 cents a half peck, and 360 quarts of syrup at 60 cents a gallon?

7. A grocer bought 12 bags of coffee for \$121.92, but finding it damaged sold it for \$30.20 less than cost. How much did he receive per bag?

8. What is the cost of a pint of molasses at \$1.04 a gallon, and 1 cwt. 35 pounds of coffee at 2 cents an ounce?

9. How many cups, each weighing 8 ounces, can be made from 30 pounds of silver, allowing 8 ounces of waste in making?

10. I had \$27.50 left after buying 3 bushels 2 quarts of cranberries at 5 cents a pint. How much money had I before buying?

III.

1. If 6 quarts of milk cost 54 cents, what will be the cost of 7 quarts?

2. A family consumed 2 pounds 4 ounces of beef daily. How much at that rate would they consume in a week?

3. What will 5 yards of cloth cost, if 12 yards cost \$48?

4. If .5 peck of corn cost 10 cents, what will .5 bushel cost?

5. A boy bought three-fourths of a peck of peanuts for 30 cents, and sold them at 7 cents a quart. How much did he make?

1. $\frac{3}{8} + \frac{1}{8} + \frac{1}{4} = \text{what?}$

6. $\frac{3}{8} + \frac{1}{10} + \frac{1}{2} = \text{what?}$

2. $\frac{2}{9} + \frac{1}{3} - \frac{1}{2} = \text{what?}$

7. $\frac{4}{9} + \frac{1}{8} + \frac{3}{14} = \text{what?}$

3. $\frac{3}{8} + \frac{1}{4} + \frac{1}{8} = \text{what?}$

8. $\frac{1}{7} + \frac{1}{3} + \frac{1}{2} = \text{what?}$

4. $\frac{3}{8} + \frac{4}{9} + \frac{1}{14} = \text{what?}$

9. $\frac{3}{8} + \frac{1}{2} + \frac{7}{8} = \text{what?}$

5. $\frac{1}{7} + \frac{4}{8} - \frac{1}{8} = \text{what?}$

10. $\frac{2}{7} - \frac{1}{7} + 2\frac{7}{8} = \text{what?}$

IV.

1. If 72 cents are paid for 18 lead pencils, how much would 1 dozen cost?

2. A milkman bought 6 gallons of milk for \$1.44, and retailed it at 10 cents a quart. How much was his whole gain?

3. What will 12 pounds 6 ounces of sugar cost at 8 cents a pound?

4. A grocer retailed flour that cost \$5.00 a barrel at 3 cents per pound. How much was his gain on .25 of a barrel?

5. A farmer bought 1 bushel and 4 quarts of timothy seed at \$3.20 per bushel. How much did it cost him?

1. A farmer having $3\frac{1}{2}$ tons of hay, bought $5\frac{3}{4}$ tons more. He then sold $6\frac{1}{2}$ tons. How much had he left?

2. If a ton of coal cost \$6.75 and a load of wood \$5 $\frac{1}{2}$, what is the difference in their cost?

3. After losing \$5 $\frac{1}{2}$ and loaning \$2 $\frac{3}{4}$, a man had \$17 $\frac{3}{4}$. How much had he at first?

4. After using $\frac{1}{4}$ yard of velvet, a lady had $\frac{7}{8}$ of a yard left. How much had she at first?

5. On Monday the tide rose $\frac{5}{8}$ of a foot the first hour, $\frac{1}{4}$ the next hour, and $\frac{3}{8}$ the third hour. How much was the rise in the three hours?

6. At 5 cents a quart, how many gallons of cider can be bought for \$4.00?

7. What will 3 yards $2\frac{1}{2}$ feet of chain cost at 24 cents a foot?

8. Harry Hicks, the blacksmith, has 30 pounds of steel which he wants to make into horse shoes, each to weigh 6 ounces. How many shoes will it make?

9. If John earns \$1.25 in 6 days, how many weeks will it take him to earn \$76.25?

10. What will be the cost of 1632 quarts of chestnuts at \$3.75 per bushel?

V.

1. If .25 pounds of feathers cost \$.25 what will 6 ounces cost?

2. A grocer retailed a barrel (31.5 gal.) of vinegar at 5 cents a quart. How much did he receive for it?

3. What will 2 gross of lead pencils cost at 20 cents a doz.

4. A boy buys chestnuts at \$2.50 a bushel, and sells them at 5 cents a pint. What is the gain on 15 bushels?

5. Find the cost of building a fence around a piece of ground, 15 rods square at 20 cents a rod.

-
- | | |
|--|--|
| 1. Add $\frac{3}{4}$, $\frac{1}{4}$, $\frac{2}{4}$. | 6. Add $\frac{3}{8}$, $\frac{3}{8}$, $\frac{1}{4}$. |
| 2. " $\frac{1}{3}$, $\frac{1}{3}$, $\frac{2}{3}$. | 7. " $\frac{5}{8}$, $\frac{3}{8}$, $\frac{1}{8}$. |
| 3. " $\frac{5}{8}$, $\frac{1}{8}$, $\frac{1}{8}$. | 8. " $\frac{3}{8}$, $\frac{1}{8}$, $\frac{3}{8}$. |
| 4. " $3\frac{3}{4}$, $5\frac{1}{4}$, $\frac{1}{4}$. | 9. " $\frac{3}{4}$, $\frac{3}{4}$, $\frac{1}{4}$. |
| 5. " $7\frac{1}{11}$, $\frac{2}{11}$, 3. | 10. " $\frac{5}{6}$, $\frac{1}{6}$, $\frac{1}{6}$. |

VI.

1. What will 1 hundred-weight and 25 pounds of leaf tobacco cost at 20 cents a pound?

2. How many thirds in 13 and one-third feet? How many half-feet?

3. How far must a man go in a day to travel 105 miles in a full week?

4. How many apples must be cut to give 150 boys $\frac{1}{4}$ of an apple each?

5. What is the value of a rectangular field, 40 rods long and 20 rods wide at \$120 an acre?

1. A man paid \$6 $\frac{1}{2}$ for a pair of boots, \$17 $\frac{3}{4}$ for a coat, and \$5 $\frac{1}{8}$ for a vest. What did he pay for all?

2. A man gave his three boys \$5.00, \$7 $\frac{1}{2}$ and \$8 $\frac{1}{2}$ respectively, and had \$10 $\frac{1}{2}$ left. How much money had he at first?

3. A farmer planted 12 $\frac{3}{8}$ acres of corn, 7 $\frac{1}{2}$ acres of oats, 9 $\frac{1}{4}$ acres of wheat and 10 $\frac{1}{12}$ acres of buckwheat. How many acres did he have under cultivation?

4. A man spent at a store \$7 $\frac{3}{8}$ for a barrel of flour, \$6 $\frac{1}{2}$ for sugar, \$5 $\frac{1}{4}$ for tea and had \$2 $\frac{1}{2}$ left. How much had he at first?

5. A grocer sold to a customer $3\frac{3}{4}$ pounds of tea, $5\frac{7}{8}$ pounds coffee, $4\frac{1}{2}$ pounds butter. How many pounds did he sell in all?

6. A grocer bought $\frac{1}{2}$ ton of cheese for \$85.15, and retailed it at $12\frac{1}{2}$ cents a pound. What was his profit?

7. What will be the cost of 7 bushels 3 pecks 4 quarts of nuts at \$2.40 per bushel?

8. In what time will a boy at 75 cents a day earn as much as a man earns in 90 days at \$2.75 a day?

9. Mr. Wilson bought 18 gallons 3 quarts 1 pint of kerosene oil at 12 cents a gallon. How much did he pay for it?

10. A gallon of paint, worth \$1.50, covers 200 surface feet. What will it cost to paint both sides of a tight board fence, 4 feet high, which encloses a lot 8 rods by 12 rods at 20 cents per square yard?

VII.

1. *If a child drink a pint of milk in a day, how many quarts will it drink in two weeks?*

2. *My pony is 13 hands high. How many feet is that?*

3. *A river is 60 feet deep. What is the depth in fathoms?*

4. *My garden contains 30 square rods. What part of an acre is that?*

5. *How many faces or sides has a body that is a cube?*

The teacher will here explain the method of finding the least common denominator, and greatest common divisor.

ILLUSTRATIVE EXAMPLE.

Express $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$ in forms of the least common denominator.

Operation.

$$\begin{array}{r} 2) 2, 6, 8 \\ \hline 1, 3, 4 \end{array}$$

$$2 \times 3 \times 4 = 24$$

$$\begin{array}{l} \frac{1}{2} = \frac{12}{24} \\ \frac{3}{4} = \frac{18}{24} \\ \frac{2}{3} = \frac{16}{24} \end{array}$$

- | | |
|---|--|
| 1. Add $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$. | 6. Add $\frac{3}{8}, \frac{4}{8}, \frac{7}{8}$. |
| 2. " $\frac{1}{4}, \frac{2}{8}, \frac{1}{2}$. | 7. " $6\frac{3}{4}, 1\frac{1}{4}, 9\frac{3}{4}$. |
| 3. " $1\frac{1}{2}, \frac{1}{2}, \frac{3}{4}$. | 8. " $6\frac{4}{10}, 2\frac{3}{10}, \frac{1}{10}$. |
| 4. " $\frac{1}{2}, 6\frac{7}{8}, 5\frac{1}{8}$. | 9. " $3\frac{1}{8}, 9\frac{1}{8}, \frac{1}{8}$. |
| 5. " $1\frac{2}{10}, 7\frac{8}{10}, \frac{3}{10}$. | 10. " $\frac{1}{10}, 2\frac{7}{10}, 9\frac{8}{10}$. |

VIII.

1. A pound of butter costs one-fourth of a dollar, and a gallon of molasses seven-eighths. What is the cost of both?

2. I pay a mason \$2 and one-fourth a day and my carpenter \$3 and one-third a day. What are their daily wages?

3. A boy had \$2 and two-fifths and lost three-fourths. How much had he then?

4. John sold a sled for \$1 and two-fifths, losing \$.25. For how much should he have sold it to gain seven-twentieths.

5. By selling a knife for three-eighths of a dollar, I lost \$.25. What was the cost? _____

1. John and James leave the school building at the same time. John walks down the street $17\frac{3}{10}$ rods, and James up the street $19\frac{1}{4}$ rods. How far apart are they then?

2. A man having $\$27\frac{3}{4}$ receives $\$16\frac{2}{10}$ for work, and then paid out $\$18\frac{1}{4}$. How much had he then?

3. How much added to the difference of $15\frac{3}{4}$ bushels, and $7\frac{1}{4}$ bushels will make $14\frac{1}{2}$ bushels?

4. A clerk earns \$75 a month. He pays $\$27\frac{3}{4}$ for

board, \$3.75 for washing, and \$15 $\frac{3}{8}$ for other expenses. How much can he save in seven months?

5. A merchant sold $4\frac{7}{8}$ yards of cloth for \$27 $\frac{7}{8}$, $8\frac{5}{8}$ yards for \$26 $\frac{1}{8}$, and $2\frac{3}{8}$ yards for \$12 $\frac{3}{8}$. How many yards of cloth did he sell?

6. Find the cost of painting 6 blackboards, each 21 feet long by 3 feet wide at 45 cents a square yard.

7. I have a garden rectangular in shape, 240 feet by 63 feet. Draw the figure representing it and tell how many square yards it contains.

8. A drover bought 247 sheep at \$4.75 per head, and 42 more at \$4.40. Eight of them died and he sold the rest at \$6 a piece. How much did he gain?

9. What will it cost to cement a cellar bottom, 36 feet long by 21 feet wide at 20 cents a square yard?

10. Mr. Winters sold a span of horses for \$483 $\frac{1}{4}$, losing \$124 $\frac{1}{4}$. For how much should he have sold them to gain \$39 $\frac{7}{10}$?

IX.

1. A grocer bought 5 packages of butter at \$7 a package. For how much must he sell it per package to gain \$10.00?

2. When maple syrup is \$1.50 a gallon, how much is that a pint?

3. At 9 cents a quart, what will a bushel of peaches cost?

4. What will 3 pounds 12 ounces of butter cost at 34 cents per pound?

5. Find the cost of .5 gallon of olive oil, when 1 dozen pints cost \$3.60.

1. A lady used $8\frac{1}{2}$ yards of cloth for a dress, and had $3\frac{3}{4}$ yards left. How many yards had she at first?

2. When a ton of meal costs $\$15\frac{1}{2}$, and is sold for $\$19\frac{1}{2}$, how much is made?

3. Willie has $\$3\frac{7}{10}$. How much does he lack of having enough to purchase a dozen pigeons worth $\$4\frac{1}{2}$?

4. How much added to $\$9\frac{3}{4}$ will make $\$14\frac{1}{2}$?

5. A grocer sold a barrel of potatoes for $\$3\frac{1}{2}$, gaining $\$1\frac{1}{8}$. Find the cost.

6. Sam had $\$8\frac{7}{10}$, earned $\$5\frac{1}{8}$, then spent $\$2\frac{1}{4}$ for a pair of skates, and $\$8.40$ for a watch. How much money had he left?

7. A speculator purchased a farm containing 275 acres for $\$16,500$, and sold it at $\$57.20$ per acre. What was his loss?

8. If $87\frac{1}{4}$ pounds of flour are taken from a full barrel, how many pounds are left?

9. My farm contains $73\frac{3}{4}$ acres, and Mr. Hunt's farm has $17\frac{1}{2}$ acres less. How many acres in both farms?

10. At what price per barrel must flour, which cost $\$9\frac{7}{10}$, be sold to gain $\$3\frac{2}{3}$?

X.

1. *Mrs. Perkins paid $\$2.80$ for 8 pounds of butter. How much was that a pound?*

2. *How many inches in a rope that is 9 feet 7 inches long?*

3. *A man bought a cow for $\$30$ and sold her at a gain of $\$13$. How much did he get?*

4. *A butcher killed 5 lambs, their total weight being 446 pounds. What was their average weight?*

5. *How many surface feet in the cover and bottom of a box, 6 feet long and 3 feet wide?*

1. I gave away $\$38\frac{3}{4}$ and had left $\$5\frac{1}{4}$. How much money had I at first?

2. If I sold a horse for $\$191\frac{3}{10}$, and gained $\$43\frac{1}{2}$, what did the horse cost me?

3. After a quantity had been used from a barrel of flour it contained 143 pounds 12 ounces. How many pounds were used?

4. A farmer sold 4 cheeses, weighing respectively $40\frac{3}{4}$, $42\frac{7}{8}$, $50\frac{1}{4}$, and 35 pounds 14 ounces. What was their entire weight?

5. A coal dealer sold to three families the following amounts. To the first $7\frac{7}{8}$ tons, the second $12\frac{1}{2}$ tons, the third 6 tons 400 pounds. How many tons did he sell to all?

6. A farmer divided his farm among his four sons, giving to each the following number of acres; to the first he gave $29\frac{1}{2}$ acres, the second $150\frac{1}{4}$ acres, the third $41\frac{3}{4}$ acres and the fourth $69\frac{3}{4}$ acres. How many acres in the farm?

7. Mr. Smith paid $\$6\frac{3}{4}$ for a ton of coal, $\$3\frac{3}{4}$ for a load of wood, $\$17.50$ for a ton of hay. He gave in payment a fifty-dollar bill. How much change ought he to receive?

8. Geo. B. Roe & Co. bought a quantity of coal for which they paid $\$1136\frac{3}{4}$, and some brick for $\$160\frac{3}{4}$. They sold the brick for $\$205.50$, and the coal for $\$1240\frac{3}{8}$. What was the whole gain?

9. Find the number of pounds of butter in 4 tubs weighing $27\frac{1}{2}$ pounds, $34\frac{3}{8}$ pounds, $32\frac{1}{2}$ pounds, and $29\frac{3}{4}$ pounds.

10. Find the cost of 26500 pounds of hay at $\$14.50$ a ton?

XI.

NOTE.—To multiply a fraction by a fraction consider the denominators divisors. Cancel equal factors.

What will $\frac{5}{8}$ of a yard of cloth cost at $\$ \frac{3}{4}$ a yard?

Operation: $\frac{5}{8} \times \frac{3}{4} = \frac{15}{32}$; or, $\frac{3}{4}$ of $\frac{5}{8} = \frac{15}{32}$.

NOTE.—To divide a fraction by a fraction *invert the divisor* and proceed as in multiplication of fractions.

How many yards of cloth at $\$ \frac{3}{4}$ a yard can be bought for $\$ \frac{5}{8}$?

Operation: $\frac{5}{8} \div \frac{3}{4} = \frac{5}{8} \times \frac{4}{3} = \frac{10}{6}$ or $1\frac{1}{3}$ yard.

- | | | |
|---|--|---|
| 1. $\frac{3}{8} \times \frac{4}{5} =$ what? | $\frac{3}{8} \div \frac{4}{5} =$ what? | $4\frac{1}{2} \times \frac{1}{3} =$ what? |
| 2. $\frac{3}{8}$ of $\frac{4}{5} =$ " | $\frac{7}{8} \times 2\frac{1}{2} =$ " | $\frac{5}{8} \div \frac{4}{5} =$ " |
| 3. $\frac{5}{8} \times \frac{3}{4} =$ " | $9 \div \frac{3}{4} =$ " | $\frac{7}{8} \times \frac{3}{4} =$ " |
| 4. $\frac{4}{5} \div \frac{1}{3} =$ " | $3\frac{1}{2} \times \frac{4}{5} =$ " | $6\frac{1}{2} \times 5\frac{1}{2} =$ " |
| 5. $\frac{7}{8} \div \frac{5}{8} =$ " | $7 \div \frac{1}{4} =$ " | $3\frac{1}{4} \div 1\frac{1}{2} =$ " |
| 6. $\frac{4}{5} \times \frac{3}{8} =$ " | $12 \div \frac{5}{8} =$ " | $\frac{7}{8} \times 3\frac{1}{3} =$ " |
| 7. $1\frac{1}{8} \div \frac{3}{8} =$ " | $\frac{8}{11} \times \frac{4}{5} =$ " | $1\frac{1}{2} \div 1\frac{1}{8} =$ " |
| 8. $\frac{5}{8} \times \frac{3}{4} =$ " | $\frac{3}{4} \times 3\frac{1}{2} =$ " | $6\frac{3}{4} \div 6 =$ " |
| 9. $\frac{4}{5} \div \frac{8}{9} =$ " | $7\frac{1}{2} \div 1\frac{2}{3} =$ " | $5\frac{1}{2} \times \frac{7}{8} =$ " |
| 10. $2 \div \frac{5}{8} =$ " | $5\frac{1}{4}$ of $4\frac{2}{3} =$ " | $\frac{1}{2}$ of $2\frac{1}{8} =$ " |

XII.

1. How many feet are there in .5 rod, and 2 yards?
2. A lady cuts 2 yards of cloth (a yard wide) into strips one-half foot wide. How many feet of strips has she?
3. How much will five eighths of a yard of cloth cost at \$2 a yard?

4. A man having a half-barrel of flour, sold one-fourth of it. How much did he sell?

5. If a man buy 5 bushels of grain for \$4, how much is that a peck?

1. A farmer sold 9 pounds of butter at $\$ \frac{1}{3}$ a pound. How much money did he receive for the butter?

2. At $\$ \frac{5}{8}$ a yard, how much will 4 yards of cashmere cost?

3. At $\$ \frac{3}{5}$ a bushel, how many bushels of corn can be purchased for \$12?

4. My farm is worth \$60 an acre; how much is $\frac{3}{4}$ of an acre worth?

5. A coal dealer divided $7\frac{3}{4}$ tons of coal among several poor families, giving to each $\frac{1}{8}$ ton. How many families did it supply?

6. A family bought 6 lbs. 9 oz. of sugar at $12\frac{1}{2}$ cents a pound. What was the cost?

7. A farmer divided 9.9 bushels of potatoes among his workmen, giving to each $\frac{9}{10}$ of a bushel. How many workmen had he?

8. How much will $4\frac{1}{2}$ yards of cassimere cost at $\$1\frac{1}{3}$ a yard?

9. A fruiterer purchased 21 baskets of peaches, each containing $\frac{3}{4}$ bushels at $\$ \frac{7}{8}$ per bushel. What was their entire cost?

10. Make into bill form and receipt the same. A. S. Wilson bought of E. J. Denning & Co. 15 yards muslin at 16 cents; 12 yards calico at 8 cents; 16 yards silk at $87\frac{1}{2}$ cents; 6 yards white flannel at 50 cents; 18 yards Canton flannel at 27 cents; 4 spools Cotton thread at 5 cents.

XIII.

1. If 4 barrels of flour cost \$24, what will two-thirds of a barrel cost?

2. If 4 pounds of maple sugar cost 60 cents, how many cents will 1 pound 4 ounces cost?

3. A farmer sold a quantity of corn for \$36, which was only .75 of its value. How much did he lose?

4. If .75 of a bushel of oats will last my pony one week, how long will 2 bushels 1 peck last him?

5. I sold a cow for \$56, and gained \$8. What should I have received for her if I had lost 8 dollars?

1. A hall is $7\frac{1}{2}$ feet wide and $20\frac{1}{2}$ feet long; how many square or surface feet does it contain?

2. Mr. Spitz sold a piano for \$275 $\frac{3}{4}$, thereby gaining \$43 $\frac{1}{4}$. What did it cost him?

3. A farmer received \$2 $\frac{3}{4}$ for $5\frac{1}{2}$ bushels of oats. How much was that a bushel?

4. At \$4 $\frac{3}{4}$ a barrel, how many barrels of flour can be bought for \$24.75?

5. A grocer sells 5 lb. 8 oz. of cheese at 9 $\frac{3}{4}$ cents a pound. How much did he receive for it?

6. A farmer sows 2 $\frac{3}{4}$ bushels of oats to the acre. How many bushels will it take to sow $7\frac{2}{10}$ acres?

7. A flour merchant bought 150 barrels of flour at \$5 $\frac{1}{2}$ per barrel. He sold 125 barrels at \$6 $\frac{1}{4}$ each, and the remainder at \$5 $\frac{1}{4}$ per barrel. How much did he gain?

8. A Long Island farmer took 16 lbs. 4 oz. of butter worth 32 cents a pound to his grocer, and received in exchange for it sugar at the rate of 7 pounds for 65 cents. How much sugar did he receive?

9. My coal for the winter cost me \$67.50. How much was that per ton, if I used $10\frac{1}{2}$ tons?

10. Put the following items in bill form and find amount: 5 pounds of tea at $62\frac{1}{2}$ cents; 3 sacks of flour at 95 cents; $40\frac{1}{2}$ pounds of sugar at \$.07 $\frac{3}{8}$; 3 lb. 8 oz. of cheese at 14 cents; 6 pounds of starch at $6\frac{1}{2}$ cents.

XIV.

1. How many bottles, holding 3 pints each, will be required to hold 5 gallons 1 quart?

2. I paid my grocer \$1.60 for 5 pounds of butter. How much was that a pound?

3. If seven-eighths of a barrel of flour is worth \$5.60, what is a barrel worth?

4. \$8 are four-fifths as much as I paid for a sheep, which I sold for \$12. How much did I gain?

5. At \$0.40 a pound, how much tea can be bought for three-fourths of a dollar?

1. Reduce $\frac{4}{9}$ of $\frac{3}{8}$ of $\frac{7}{9} \times 8\frac{1}{2} \times \frac{7}{9}$ to a simple fraction in lowest terms.

2. What will $13\frac{7}{10}$ tons of coal cost at \$6 $\frac{7}{8}$ a ton?

3. Mrs. Rosa bought a bag of corn containing $1\frac{1}{2}$ bushels for \$1 $\frac{2}{3}$. What was that a bushel?

4. A grocer, by selling $4\frac{1}{2}$ gallons of molasses at \$ $\frac{8}{9}$ a gallon, gains \$ $\frac{8}{9}$. What was the whole cost?

5. At \$ $\frac{3}{4}$ a pound, how many pounds of feathers can be bought for \$7 $\frac{3}{4}$?

6. A barrel of beef, which holds 200 pounds, was $\frac{3}{4}$ full. How many pounds would there be left in it after $53\frac{3}{4}$ pounds were taken out?

7. At $7\frac{1}{2}$ cents a pound, how many pounds of sugar can be bought for \$2.40?

8. At $\$5\frac{1}{2}$ a square foot, how many square feet of land can be bought for \$203?

9. If $\frac{3}{4}$ of a yard of ribbon cost 21 cents, what will $2\frac{1}{4}$ yards cost?

10. Find the amount of the following meat bill: 2 lb. 10 oz. steak at 24 cents; 3 lb. 6 oz. lamb chops at 16 cents; 1 lb. 12 oz. sausage at 20 cents; 3 lbs. 9 oz. mutton at 12 cents; $7\frac{1}{4}$ pounds turkey at $18\frac{1}{2}$ cents.

XV.

1. How many times can a 2 quart measure be filled from a keg, which holds 7.5 gallons of vinegar?

2. If .25 ream of paper cost one-third of a dollar, how much is that per ream?

3. How many gallons of oysters at two-fifths of a dollar a quart, can be bought for \$4.00?

4. A farmer bought .75 bushels of grass seed at \$5 a bushel. How much did it cost him?

5. How many bushels of corn at five-eighths of a dollar a bushel, will it take to pay for 40 pounds of butter at \$0.20 a pound?

1. A man having $\$5\frac{1}{4}$ bought a knife, and then had left $\$4\frac{3}{8}$. How much did the knife cost?

2. If a turkey weighing $9\frac{1}{2}$ pounds cost \$1.33, what would one cost that weighs $14\frac{1}{4}$ pounds?

3. What will $18\frac{3}{4}$ pounds of beef cost at $18\frac{3}{4}$ cents a pound?

4. If $3\frac{1}{2}$ yards of cloth cost \$8 $\frac{3}{8}$, what will $2\frac{1}{4}$ yards cost?

5. A merchant bought goods which cost him \$364.90, and sold them at a gain of \$47 $\frac{3}{8}$. How much did he receive for the goods?

6. If 12 $\frac{1}{2}$ pounds of rice cost \$1 $\frac{2}{8}$, how much will 7 $\frac{1}{4}$ pounds cost?

7. If it cost 74 $\frac{1}{4}$ cents to build a rod of fence, how many rods can be built for \$18.11 $\frac{7}{8}$?

8. A farmer sold 17 $\frac{1}{3}$ cords of wood at \$9 $\frac{1}{2}$ a cord, and received in payment wheat at \$ $\frac{3}{8}$ per bushel. How many bushels did he receive for the wood?

9. What is the cost of 15 boxes of starch, each containing 7 $\frac{1}{2}$ pounds at 6 $\frac{1}{4}$ cents a pound?

10. Put into bill form and receipt same.

New York, July 5, 1890.

Chas. Post,

	Bo't of Adams & Howe.
250 pounds butter,	at \$0.28 $\frac{1}{2}$
15 $\frac{1}{2}$ " coffee,	" .28 $\frac{1}{4}$
241 " sugar,	" .08 $\frac{7}{8}$
25 " tea,	" .25
3 baskets peaches,	" .35
1 box soap,	" 4.25

Received Payment,

ADAMS & HOWE.

XVI.

1. A man sold .25 acre of land at \$2 a square rod. How much money did he receive for it?

2. What will a mile of telephone wire cost at 1.5 cents a foot?

3. A parlor is 18 feet wide and 24 feet long. How many yards of carpeting, a yard wide, will be needed for it?

4. If .5 pound of coffee cost \$.15, what will 8 pounds cost?

5. What will 2 pounds of steak cost, if 3 pounds 4 ounces cost \$1.04?

1. What will $2\frac{1}{2}$ yards of flannel cost at $\$ \frac{2}{3}$ a yard?

2. Find the cost of $\frac{3}{4}$ of a yard of silk, when $\frac{7}{8}$ yard cost \$3.50?

3. At \$9 $\frac{1}{2}$ a barrel, how many barrels of flour can be had for \$85 $\frac{1}{2}$?

4. At \$5 $\frac{1}{2}$ a bushel, how much timothy seed can be bought for \$8 $\frac{3}{4}$?

5. If \$2.80 will buy $\frac{7}{8}$ of a ton of coal, how much could you buy for \$2.70?

6. Mr. Smith bought a horse, paying \$120 down, which was $\frac{2}{3}$ of the cost. How much remained unpaid?

7. C. A. Gould sold a cow for \$30, which was $\frac{3}{4}$ of what she cost him. How much did he lose?

8. I pay \$57 for 8 $\frac{1}{2}$ tons of coal. How much is that a ton?

9. I paid \$ $\frac{1}{2}$ per basket for grapes. How much would 5 $\frac{1}{2}$ baskets cost?

10. Put into bill form and find the amount: 8 boxes raisins at \$6.25 ; 150 pounds of sugar at \$.07 $\frac{1}{2}$; 12 pounds of currants at 20 $\frac{1}{2}$ cents ; 52 gallons kerosene at 12 $\frac{1}{2}$ cents; 12 $\frac{1}{2}$ pounds butter at 40 cents; 25 pounds lard at 16 cents; 3 barrels potatoes at \$1.75; 1 barrel flour at \$10.75; 4 bags feed at \$1.12 $\frac{1}{2}$.

XVII.

1. *In five-eighths of a dollar how many cents ?*
2. *What will three-fourths of a ream of paper cost at 10 cents a ream ?*
3. *What will a peck of nuts cost at 2 and two-thirds dollars a bushel ?*
4. *James worked 40 minutes at the rate of three-eighths of a dollar an hour. How much did he earn ?*
5. *A lumberman paid 3 and one-fifth dollars for shoeing two yoke of oxen. How much did it cost him to shoe each ox ?*

1. If 3 $\frac{1}{2}$ yards of cloth cost \$10, what will $\frac{3}{4}$ of a yard cost?
2. If 6 $\frac{1}{2}$ pounds of sugar cost \$3 $\frac{5}{8}$, how much will 8 pounds cost?
3. If butter is worth \$ $\frac{3}{4}$ a pound, how many pounds and ounces can I buy for \$6 $\frac{3}{4}$?
4. If $\frac{3}{4}$ of a yard of cloth cost \$1.40, what will 2 $\frac{2}{5}$ yards cost?
5. At \$9 $\frac{1}{2}$ a barrel, how many pounds of flour can be bought for \$3 $\frac{1}{4}$?
6. If \$3 $\frac{1}{2}$ will buy 2 $\frac{1}{8}$ bushels of wheat, how many bushels will \$17.50 buy?
7. When hay is worth \$9.75 a ton, what is $\frac{3}{4}$ of 3 $\frac{1}{2}$ tons worth?

8. If 16 bushels cost \$12, how many bushels can be bought for \$1 $\frac{1}{2}$?

9. If $\frac{3}{4}$ bushels of wheat cost \$4 $\frac{1}{2}$, how much can be bought for \$38 $\frac{1}{2}$?

10. Put the following in bill form, and find the amount: 25 pounds butter at \$0.35; 24 pounds coffee at \$.14 $\frac{1}{2}$; 48 pounds sugar at \$.09 $\frac{1}{2}$; 47 pounds lard at \$.15 $\frac{1}{2}$; 2 barrels flour at \$6.20; 4 gallons molasses at \$.62 $\frac{1}{2}$; 3 bushels potatoes at \$.87 $\frac{1}{2}$; 2 pounds and 6 ounces cheese at \$.16.

XVIII.

1. If a pound of sugar cost 9 cents, how many pounds may you buy for \$2.34?

2. A man having one-half a barrel of flour, gave one-fourth of it away. How much had he left?

3. What cost 2 gallons and 2 quarts of milk at 3 cents a pint?

4. What cost 1 pound 4 ounces of nutmegs at 60 cents a pound?

5. How many rods around a field one-fourth of a mile square?

1. How many barrels of apples at \$1 $\frac{1}{2}$ a barrel can be bought for \$8 $\frac{1}{2}$?

2. If $\frac{1}{2}$ yard of cloth cost \$2 $\frac{1}{2}$, what will $\frac{3}{4}$ of a yard cost?

3. Find the cost of $\frac{2}{3}$ of a ton of coal, if 5 tons cost \$24?

4. If 2 $\frac{1}{2}$ tons of hay cost \$31 $\frac{1}{2}$, what will 8 $\frac{1}{2}$ tons cost?

5. What will 8 $\frac{1}{2}$ acres of land cost at \$28 $\frac{7}{8}$ per acre?

6. How many feet in 5 $\frac{2}{3}$ rods and 4 $\frac{1}{2}$ yards?

7. What cost $5\frac{3}{4}$ pounds of butter, if $1\frac{1}{2}$ pounds cost 30 cents?

8. If $\frac{3}{4}$ of a yard of cloth cost $\$ \frac{4}{5}$, what is the price per yard?

9. How many bushels of oats at $\$ \frac{3}{8}$ a bushel, will cost $\$12\frac{1}{2}$?

10. The following goods were sold by H. B. Claflin & Co., New York, to J. B. Hoyt & Co., Flushing, L. I., March 31, 1890: 1 case cassimeres, 176 yards, at $\$1.50$; 2 cases prints, 850 yards at $7\frac{1}{2}$ cents; 1 bale drilling, 578 yards at $12\frac{1}{2}$ cents; 12 dozen Coat's thread at 60 cents; 50 gross horn buttons at $87\frac{1}{2}$ cents. Find amount of bill.

XIX.

1. At 12 cents a pint, how many gallons of syrup may I buy for $\$3.84$?

2. A grocer sold me 6 quarts 1 pint of berries. What part of a peck was that?

3. At 10 cents a square yard, what will it cost to paint a ceiling 20 feet long and eighteen feet wide?

4. If one-fourth hundred-weight of beef cost $\$2.50$, how much will 40 pounds cost?

5. How many rods of fence will enclose a farm one-fourth of a mile square?

1. If $2\frac{1}{2}$ bushels of potatoes are worth $\$3\frac{1}{2}$, how much is that a bushel?

2. What will be the cost of 6 lb. 14 oz. of tea at $65\frac{3}{4}$ cents a pound?

3. If 3 dozen lemons cost $\$1\frac{1}{8}$, what will be the cost of 56 lemons?

4. A merchant bought 76.75 yards of cloth for $\$115\frac{1}{8}$, and sold $14\frac{7}{8}$ yards at an advance of $\$1\frac{1}{4}$. How much did he receive for it?

5. At $\$4$ per ton for coal, how many pounds can be bought for $\$3\frac{1}{2}$?

6. If $\frac{2}{3}$ of 2 barrels of flour cost $\$2\frac{2}{3}$, how many barrels can be bought for $\$26\frac{2}{3}$?

7. A grocer bought $84\frac{1}{2}$ barrels of flour at $\$5\frac{1}{2}$ per barrel, and sold it at $\$6.25$ per barrel. What was his gain?

8. If $\frac{2}{3}$ of a barrel of flour cost $\$1\frac{1}{3}$, what is the cost of $5\frac{1}{3}$ barrels?

9. A farmer bought $5\frac{1}{2}$ yards of broadcloth at $\$4\frac{1}{2}$ a yard, and gave in payment wheat at $\$1\frac{1}{2}$ a bushel. How many bushels did it take?

10. The following goods were sold in Cincinnati, O., June 5, 1890, by Baker, Smith & Co., to Thos. Knight: 48 pounds castile soap at $16\frac{2}{3}$ cents; 25 pounds starch at $6\frac{1}{2}$ cents; 65 pounds sugar at $7\frac{2}{3}$ cents; $31\frac{1}{2}$ gallons vinegar at 25 cents; 16 pounds Rio coffee at 23 cents; 56 pounds butter at $33\frac{1}{2}$ cents. Find amount of bill.

XX.

1. If two-thirds of a dozen bananas cost 20 cents, what will five-sixths of a dozen cost?

2. $\$28$ is seven-eighths of my money. How much have I?

3. My trunk is 3 feet long, 2 feet wide and 2 feet deep. How many square feet of zinc will be required to cover it?

4. A black-board in the school-room is 12 feet long and 3 feet wide. What will it cost to slate it at three-fourths of a dollar per square yard?

5. If 2 and one-half yards cost $\$5$, what will 7 and one-half yards cost?

1. If $\frac{3}{4}$ of a ton of hay cost $\$9\frac{1}{2}$, what will $2\frac{3}{4}$ tons cost?
2. A farmer bought $5\frac{1}{2}$ yards of broadcloth at $\$4\frac{1}{2}$ a yard, and paid for it in potatoes at $\$1\frac{1}{2}$ a barrel. How many barrels did it take?
3. What is the cost of $3\frac{1}{2}$ bushels of oats, at $\$4\frac{2}{3}$ for 7 bushels?
4. If $5\frac{1}{2}$ pounds of tea cost $\$4\frac{2}{3}$, what will $\frac{2}{3}$ of a pound cost?
5. When hay is worth $\$9\frac{1}{2}$ a ton, what will $\frac{2}{3}$ of $3\frac{1}{2}$ tons cost?
6. At $\$1\frac{1}{2}$ for one-half pound, how much butter can be purchased for $\$3\frac{1}{2}$?
7. In $2\frac{1}{2}$ acres of land, how many building lots of $\frac{3}{8}$ of an acre each?
8. If $\$6,000$ is $\frac{2}{3}$ of the value of my farm, what is $\frac{2}{3}$ of its value?
9. If $\frac{3}{4}$ -yard of cloth cost $\$1\frac{2}{3}$, what will $\frac{1}{12}$ of a yard cost?

10. NEW YORK CITY, June 6, 1891.

MR. SAM'L. LORD,

Bought of E. J. DENNING & Co.

40	yds. Cassimere, . . .	2.50				
420	" Sheeting, . . .	7 $\frac{1}{2}$				
42	" Black Silk, . . .	1.75				
30	" " Cashmere, . . .	1.15				
64	" Fisher's Tweed,75				
16	Thousand Milward's Needles, 2.37 $\frac{1}{2}$					

Received Payment,

PERCENTAGE.

In many computations it is convenient to use the number 100 as a basis of comparison. In such cases we do not say, 6 in every 100, 10 in every 100, 25 in every 100, etc., but 6 per cent., 10 per cent., 25 per cent., etc. The 6, 10 and 25 we call the rate per cent. The rate then is a definite part of 100. The sign of PER CENT. is %, and is affixed to RATE, as 6%, 10%, 25%, and *expressed* in four ways:

As a decimal, thus— .25

As a common fraction, thus— $\frac{25}{100}$ or $\frac{1}{4}$

By the use of the symbol, %.

By the words—PER CENT.

The teacher should explain the operations of PERCENTAGE by using the common fraction. Insist upon the pupils working problems by these forms whenever the *per cent.* represents a fraction in a small or reduced form. Below will be found a few *per cents.* in *reduced* common fraction forms.

$6\frac{1}{4}\% = \frac{1}{8}$.	$14\frac{2}{3}\% = \frac{1}{3}$.	$25\% = \frac{1}{4}$.	$50\% = \frac{1}{2}$.
$8\frac{1}{3}\% = \frac{1}{3}$.	$16\frac{2}{3}\% = \frac{1}{3}$.	$33\frac{1}{3}\% = \frac{1}{3}$.	$62\frac{1}{2}\% = \frac{5}{8}$.
$12\frac{1}{2}\% = \frac{1}{8}$.	$20\% = \frac{1}{5}$.	$37\frac{1}{2}\% = \frac{3}{8}$.	$66\frac{2}{3}\% = \frac{2}{3}$.

I.

1. A boy gave 6 marbles out of every hundred he had. How many did he give away of 500?

2. A man having 200 sheep, sold 10 out of every hundred. How many did he sell?

3. A man has 200 hens and sells 25 out of every one hundred. How many hens has he left?

4. A farmer had 180 sheep and sold 20 per cent. of them. How many did he sell?

5. A merchant bought hats at \$36 per dozen and sold them at an advance of 16 and two-thirds per cent. How much did he receive for each hat?

1. A farmer sold 25 % of his farm which consisted of 204 acres, at \$37½ per acre. How much did he receive for it?

2. A boy going to market with 15 dozens of eggs, broke 10 % of them. How much was the loss at 36 cents a dozen?

3. A merchant having 470 barrels of flour, sold 20 % of it at \$5.25 per barrel. How much did he receive for it?

4. I have a farm of 360 acres of land. If I sell 33½ % of it how much will I have left?

5. A carriage that cost \$264 was sold at a loss of 16⅔ %. What sum was received for it?

6. James sold a gun that cost him \$30 for 20 % less than it cost him. What did he lose?

7. A young man's salary is \$1200 a year ; of this, he spends 12½ % for clothes, and \$10 a week for other expenses. How much can he save during the year?

8. A grocer sold flour that cost \$5.04 a barrel at a gain of 14⅔ per cent. How much did he receive per barrel?

9. A merchant buys boys' suits at \$2.25 each, and marks them at an advance of 33½ %. What is his marked price?

10. If the bread made from two barrels of flour weighs 25 % more than the flour, what is the weight of the bread?

II.

1. A gain of \$2 on \$4 is a gain of how many dollars on the hundred?

2. A gain of \$3 on \$5 is a gain of how many dollars on the hundred?

3. A boy sold a goat that cost \$4 at a gain of \$2. What was his gain per cent.?

4. A farmer sold a cow that cost \$25 at a profit of \$15. What was the per cent. of gain on the cow?

5. A sheep which cost \$7 was sold for \$8. What per cent. or part of the cost was the gain?

1. A grocer sells tea that cost him 60 cents a pound for 75 cents. What per cent. of the cost is the gain?

2. A piano which cost a dealer \$420 was sold for \$480. What per cent. was made?

3. A boy bought a drum for \$4, and sold it for \$6. What per cent. of the selling price was gain?

4. A merchant sells sugar at \$.05 a pound, that cost him \$.04. What part of the selling price is gain?

5. A drover buys sheep at \$7 per head, and sells at \$8 per head. What is his per cent. of gain?

6. A hardware merchant sold a stove at 20% above cost, and made \$4. What was the cost of the stove?

7. A merchant sold calico at 25% profit, and made 2 cents a yard. What was the cost of the calico per yard?

8. A farmer sold a cow at a gain of $33\frac{1}{3}\%$ over her cost, and made \$15. What was the price received for the cow?

9. A furniture dealer sold a desk at $16\frac{2}{3}\%$ profit, and made \$3.00. What was the price received for the desk?

10. A grocer retails pork at 14 $\frac{1}{2}$ per cent. gain, and makes \$2 on a barrel. What is his retail price per pound?

III.

1. A merchant bought a dozen hats for \$48, and sold them at a profit of \$2 on each hat. What per cent. did he make?

2. A merchant sold a pair of boots at a profit of 10 per cent. and thereby gained 50 cents. How much did he get for the boots?

3. A stove which cost \$12 was sold at a gain of \$3. What was the per cent. of gain?

4. What per cent. does a man lose who buys a saddle for \$12; and sells it for \$10?

5. A book which cost \$2 was sold at a loss of 50 cents. What was the loss per cent.?

1. A man bought a cart for \$40, and afterwards sold it at a loss of 12 $\frac{1}{2}$ %. How much did he get for it?

2. Samuel Smith sold a village lot for \$900, gaining \$100 on the sale. What per cent. did he make?

3. By selling beef at \$21 a barrel, 16 $\frac{2}{3}$ % was gained. What was the cost per pound?

4. A grocer sold butter at a profit of 20 %, and made 6 cents on a pound. What was his selling price?

5. How much is made by selling flour at 20 % profit which cost \$4.75 a barrel?

6. A grocer buys tea at 45 cents a pound, and sells it at 60 cents a pound. What is his gain %?

7. A profit of \$3 was made on a desk which was sold for \$27. What was the % gained?

8. If you buy a book for 60 cents, and sell it for 20 cents more than you pay for it, what is your per cent. of gain?

9. A hackman bought a horse for \$200, and sold it for \$50 less than he paid for it. What per cent. was his loss?

10. A fruiterer bought cocoa-nuts at \$7.00 a hundred, and sold them at 10 cents each. What was his per cent. of profit?

IV.

1. When we enjoy the use of property belonging to others we usually pay for the same. When we hire money we pay for its use. The money paid is called Interest.

2. When we hire money at 6 per cent. per annum, how many dollars should be paid for the use of \$200 for one year?

3. At 5 per cent. per year how much must be paid for the use of \$5 for 1 year? 3 years?

4. What is the rate of interest when \$8 are paid for the use of \$200 for 1 year?

5. I hire \$300, and agree to pay 5 per cent. interest for its use. How much shall I owe the lender in 2 years?

1. Mr. Jones hired \$340.60 for 2 years 4 months at 7% per annum. How much was due the lender for its use?

EXPLANATION.	OPERATION.	
Since the interest for 1 year is 7% or .07 of the sum borrowed, the interest of \$340.60 for 1 year at 7% is .07 of \$340.60 or \$23.842; the interest for the whole time is $2\frac{1}{3}$ times this or \$55.63.	\$340.60	Principal
	.07	Rate
	<hr/>	
	\$23.8420	Int. for 1 year.
	$2\frac{1}{3}$	Time
	<hr/>	

\$55.6313 Int. for 2 yrs. 4 mo.

2. A merchant hires \$800 for 3 years at 10%, or \$10 for every \$100 for each year. How much will he have to pay for the use of the money?

3. A farmer hires \$600 on his note due in 1 year at 6 per cent. How much interest will he have to pay ?

4. A grocer hired \$400 at 6% per annum, and with it purchases pork at \$16 a barrel. During the next year and a half he sells it all at an advance of 25%. How much was his net gain ?

5. I bought a house and lot in Flushing for \$4,500, paying \$2,000 cash, balance in mortgage due in 3 years and 6 months with interest. What was the amount of the mortgage when due, interest at 6% ?

6. What is the interest on \$350 for 3 years and 4 months at 6% ?

7. A gentleman sold a house which cost him \$1,500 at an advance of 20%. He owned the house 3 years, and received an annual rental of \$100 above taxes, insurance, and repairs. How much did he make if money earns 10% per annum ?

8. Mr. Smith loans a merchant \$600 for 3 years at 6% interest. During this time he trades with the merchant to the amount of \$275. At the end of three years, how much will be due Mr. Smith if the merchant charges no interest on the goods sold ?

9. A note of \$250 bearing interest at 6% annually was given Oct. 10, 1890. How much interest was due on this note, Dec. 10, 1891 ?

10. A note for \$450 at 6% annual interest, dated Glen Cove, L. I., April 16, 1890, was paid January 26, 1892. What was the amount due ?

V.

1. At \$6 a year, how much should be paid for the use of \$100 for 4 years ?

2. A farmer hires \$600 for 2 years at \$5 a hundred per year. How much interest will he have to pay?

3. A business man hires \$400 for 3 years at \$6 a hundred per year (6 per cent.) How much will he have to pay for its use?

4. At 6 per cent. a year, how much would I have to pay for the use of \$300 for 2 years and 6 months?

5. What is the interest of \$40 for 2 and one-fourth years at 6 per cent.?

1. What is the interest of \$150.50 for 2 years and 4 months at 6%?

2. A man pays \$375 a year for rent of a house worth \$6,000. Will he gain or lose, and how much in 3 years, if he borrow money at 5% to purchase the house? Taxes and insurance on the house amounting to \$45 per annum.

3. I hire \$500 of a friend for 3 years and 3 months, at 6%. What do I owe him at the end of the time?

4. I owe a merchant \$540 and agree to pay him the debt in 6 months, with interest at 6%. How much shall I have to pay him?

5. If I hire \$320 May 1, 1889, and pay it with 6% interest February 1, 1892, how much do I pay?

6. What is the interest on \$140 for 3 years and 3 months at 7%?

7. A merchant hired \$500 January 5, 1890, and promised to pay it July 5, 1892, with 6% interest. What does the use of the money cost him?

8. What is the interest of \$800 for 1 year 3 months at 8%?

9. A lady bought a village lot for \$800, and paid cash \$300, the balance on mortgage for 1 year with interest at 6%. What amount was due at the expiration of the time?

10. WHITESTONE, L. I., Jan. 31, 1892.

Three months after date, for value received, I promise to pay James F. Smith, or order, one hundred and fifty dollars, with interest at 6 per cent.

\$150.

I. J. MERRITT.

PRACTICAL MEASUREMENTS.

SUGGESTIONS AND HINTS.

Whenever practicable draw a figure, or use an object, illustrating each problem in the following lessons before attempting the work.

A **Surface** has two dimensions, length and breadth. The **area** of a **surface** is expressed by the product of these two dimensions.

All **dimensions** must be reduced, if not already so, to the same unit.

A **rectangle** is a plane figure bounded by four straight lines, and having four equal angles.

A **square** is a plane rectangle bounded by four straight lines of equal length, forming four right angles.

A **triangle** is a plane figure bounded by three straight lines. The base is the line upon which the triangle stands. The altitude is the perpendicular distance from the base to the point where the opposite lines of the triangle meet (vertex). The **area** of a **triangle** is one half the area of a parallelogram of the same base and altitude.

The **public lands** of the United States, which have been surveyed in the West and South during the present century, have been laid out in Townships and Sections. A **township** is made up of (36) **sections** and is 6 miles **square**. Each section is a **mile square**. These sections are designated by numbers, beginning at the northeast corner, and numbering left and right, back and forth as shown in the diagram.

A TOWNSHIP.

N					
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36
S					

A SECTION.

N		
N.W. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ 40 Acres.	E. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ 80 Acres.	N.W. $\frac{1}{4}$ 160 Acres.
S. $\frac{1}{4}$ 320 Acres.		

A **rectangular solid** has three dimensions and six rectangular surfaces. If these **faces** are all equal it is a **cube**. These three dimensions must be *worked in units of the same kind*.

Volume is the space inclosed within the bounding surface. The **volume** of a cylindrical body is found by multiplying the **area** of the bottom or base, by the height or altitude.

The **curved surface** of a cylinder is equal to the product of its circumference by its altitude, the height. This surface when **flat** is in the form of a rectangle. A saw-log is a cylinder, its length being its **altitude**, and the distance around it the **circumference**.

The **circumference** of a circle is *about* $3\frac{1}{2}$ times the diameter.

The **area** of a *circle* is equal to the product of half the circumference by the radius; or the product of the diameter by itself, multiplied by .7854.

In measuring floors, walls and roofs of buildings, sides of a house, etc., the pupils will notice that they are simply rectangles. In measuring for the carpeting of rooms, first find how many strips it will take, according as the strips are to run lengthwise or crosswise of the room. To find the number of strips or lengths, divide the width or length of the room *in inches* by the width of the carpet *in inches*. In cutting carpets to fit rooms, an allowance is made for waste in matching the figures.

A **square** of tin in roofing is 10 feet by 10 feet, or 100 square feet.

All sawed lumber is counted in board-feet. The **board-foot** is the unit of measurement, and equals a *square foot of board* 1 inch thick. To find the number of feet in a stick of lumber, multiply its length in feet, by its width or *average* width in feet or parts of a foot, and then by the *number of inches* in thickness.

A **cord** of wood is a **range** of 4-foot wood, 8 feet long, and 4 feet high, and equals 128 cubic feet. A **cubic yard** or a **load** of earth, is 27 cubic feet. **Cellars** and other excavations of earth are estimated by the cubic yard. Brick-work is estimated by the 1000 bricks; 27 bricks to the cubic foot, laid dry, or *21 bricks when laid in mortar*. Stone is estimated by the perch, which is stone *laid* $16\frac{1}{2}$ feet long, $1\frac{1}{2}$ feet thick, and 1 foot high, or $24\frac{3}{4}$ cubic feet.

A **gallon** contains 231 cubic inches. A box 12 inches **square** (1,728 cu. in.) will hold *about* $7\frac{1}{2}$ gallons.

A **bushel** contains 2150.4 cubic inches, or *about* $1\frac{1}{4}$ cu. feet.

I.

1. Your teacher's table in class-room is 6 feet long, and 2 feet wide. How many feet of oil-cloth will cover it?

2. The teacher's desk is 4 feet long, and 2.5 feet wide. How many square feet does the top contain?

3. Your slate is 10 inches long, and 6.5 inches wide. How many square inches are there in both sides?

4. How many slates, 8 inches long and 6 inches wide, will cover a desk 16 inches by 9 inches?

5. My garden is 10 rods wide, and 16 rods long. How much land does it contain?

1. How many square yards in the floor of a room, 15 feet by 18 feet?

2. How much will it cost to slate the walls for 9 blackboards, at 40 cents a square yard, each being 27 feet by 3 feet?

3. How many square rods in my garden, which is 545 feet long and 82 feet wide?

4. What will it cost to cement a cellar bottom, 36 feet long by $25\frac{1}{2}$ feet wide, at 25 cents a square yard?

5. What will it cost to paint a fence, which is 6 feet high, that surrounds a mile race-course, at 10 cents a square yard?

6. What will it cost to pave a street, one mile long and 99 feet wide, at 45 cents a square foot?

7. Find the cost of fencing a rectangular field, 80 rods long and 36 rods wide, at 65 cents a rod?

8. How much will it cost to lath and plaster the four walls and ceiling of a room, 25 feet long, 15 feet wide, and 14 feet high, at 20 cents a square yard? No allowance being made for doors or windows.

9. A farmer sold 71,200 pounds of hay at \$11 a ton, and with part of the money purchased 9,812 feet of boards at \$15 per thousand. How much money had he remaining?

10. How many yards of carpeting, a yard wide, will it take to cover a room 24 feet by 15 feet?

II.

1. How many square yards in a rug 6 feet long and 3 feet wide?

2. How much will it cost to paint the floor of my office, which is 15 feet long and 6 feet wide, at 25 cents per square yard?

3. How many square yards of oil-cloth will it take to cover the floor of my library, which is 18 feet long by 6 feet wide?

4. How much will it cost to plaster the ceiling of my office, 15 feet long by 6 feet wide, at 40 cents a square yard?

5. How many square yards in the four walls of a cloak-room, 10 feet high and 18 feet square?

1. Find the cost of a piece of oil-cloth, 24 feet long and 15 feet 9 inches wide, at 85 cents a square yard?

2. What will it cost to carpet a room, 15 feet 9 inches by 12 feet 6 inches, with carpet 27 inches wide at \$1.00 a yard? The breadths are to run crosswise of the room. No allowance for waste in matching.

3. How many rolls of wall paper, each being 8 yards long, will be required to paper the four walls of a hall, 72 feet long, 30 feet wide, and 14 feet high; no allowance for apertures, the paper being 2 feet wide?

4. What will it cost to carpet a room 18 feet long, $15\frac{1}{2}$ feet wide, at \$1.50 a yard, carpeting being $\frac{3}{4}$ of a yard wide?

5. Find the cost of plastering the walls and ceiling of a school-room, 72 feet long, $22\frac{1}{2}$ feet wide, and 16 feet high, at $17\frac{1}{2}$ cents a square yard, allowing a deduction of 250 square feet for doors and windows?

6. I wish to carpet two rooms each $22\frac{1}{2}$ feet by 18 feet, with carpeting $\frac{3}{4}$ of a yard wide. If I run the breadths lengthwise of the room, how much will it cost at \$1.25 a yard?

7. How much will it cost to carpet the above rooms if the strips of carpet run crosswise of the room, and an allowance of 6 inches to each breadth is made for matching the figures in carpet?

8. How many square feet of boards will be required to cover the roof of a house, which is 42 feet long, the rafters being 18 feet long, and the roof projecting over 2 feet at each gable end?

9. How much will it cost to roof the above house with slate, at \$6.25 per "square" of 100 feet?

10. One thousand (1000) lath cover 700 feet of surface, and 9 pounds of nails fasten them. What will it cost to lath and plaster a school-house, 42 feet long, 30 feet wide, and 14 feet high at \$2.50 a thousand for lath, 6 cents a pound for nails, and $13\frac{1}{2}$ cents a square yard for labor and plaster?

III.

1. How many square yards of cloth will be required to cover a rectangular table, 9 feet long and 3 feet wide?

2. How many square feet of zinc will be required to line the four sides and bottom of a refrigerator 3 feet deep, 5 feet long, and 2 feet wide?

3. How many square feet in the gable ends (a triangle) of a pitched-roof house, which is 18 feet wide and 7 feet to ridge-pole from the base line?

4. My lawn roller is six feet in circumference (around it), and 3 feet long. How many square feet of sheet iron will it take to cover its rolling surface?

5. I wish to cover with tin the roof of my dog house. How many square feet will it take, if each side of the roof is 6 feet long, and 2.5 feet wide?

1. How many planks, 12 feet long, 6 inches wide, will it take to cover a barn floor 68 feet by 18 feet?

2. How many acres in a rectangular field, 48 rods long and 45 rods wide?

3. How many square feet of zinc will it take to line an open water tank 6 feet deep, having a square bottom, each side of which is 4 feet 6 inches?

4. How much will it cost to plaster and paint the walls and ceiling of a room, 18 feet long, 16 feet wide, and 12 feet high, at $33\frac{1}{2}$ cents per square yard; no allowance being made for windows or door?

5. How many square yards in the gable ends of a house which is 36 feet wide and 13 feet 6 inches high, perpendicular, from base line to ridge-pole or peak?

6. What is the area, or number of surface feet, in the outside measurements of a house (not including the roof) 40 feet long, 32 feet wide and 22 feet to the plates, the gable ends being 14 feet 6 inches from the base line to the ridge-pole, or peak of the house?

7. My horse is fastened to a stake by a rope 60 feet long. He can feed over a circle, which has a circumference of 377 feet. What is the amount of land fed over by the horse?

8. How much will be the cost of cementing a cistern at 25 cents per square yard, which is 6 feet square and 5 feet deep?

9. A farmer has a cylindrical roller 7 feet long and 5 feet in diameter and wishes to cover its rolling surface with sheet iron, at a cost of 5 cents per square foot. What will be the cost of the material?

10. A circular tank, 10 feet deep and 7 feet in diameter, with a circumference of 22 feet, is to be lined with zinc at 5 cents a square foot. What will it cost?

IV.

1. *At 20 cents a square yard, what will it cost to paint a ceiling 18 feet by 20 feet?*

2. *How many square yards in a court, 20 yards long, 36 feet wide?*

3. *How many acres of land in a lot 20 rods long, 16 rods wide?*

4. *How many rolls of wall paper will it take to cover the ceiling of a room 18 feet by 15 feet, each roll being 8 yards long and 1.5 feet wide?*

5. The gables of my carriage house are in the form of triangles, with bases 30 feet, and altitudes 12 feet, (the distance from the base line to the peak). How much will it cost to paint both gables at 2 cents a square foot?

1. At 10 cents a square yard, what will it cost to kalso mine the four walls of a room, 26 feet long, 22 feet wide and 10 feet 6 inches high?

2. How many "squares" of tin will be required to cover the two sides of a roof, each being 40 feet long by 25 feet wide?

3. Find the cost of plastering the four walls and ceiling of a room, 20 feet long, 14 feet wide, and 10 feet high at 18 cents per square yard; allowance being made for 3 windows, each 7 feet by 3 feet 6 inches; 2 doors each 8 feet by 3 feet 3 inches, and a fire place 4 feet by 5 feet?

4. At 15 cents a square yard, what will it cost to paint the roof of a house which is 40 feet long, having a 2-foot projection at each of the two gables, the rafters being 18 feet in length?

5. The above building is 40 feet long, 30 feet wide, the posts being 22 feet in length. Find the cost of painting the four sides and gables, with two coats of paint at 20 cents a square yard, the gables being $14\frac{1}{2}$ feet perpendicular from the base to the peak of the house? No allowance for doors and windows, these to off-set the painting of the 2-foot projection under the roof.

6. Allowing 1000 shingles to cover 100 square feet (a square), how many bunches, of 250 shingles each, will be required to cover the roof of a house 50 feet long, the roof on each side of ridge pole being 20 feet from eaves to the peak?

7. How many feet of zinc will it take to line an ice box, 4 feet by 5 feet on the bottom and 3 feet deep? The cover to be lined.

8. A frame house is 42 feet long, 28 feet wide, and 18 feet high to the plate, with two gables,—each gable being 15 feet high from the base line to ridge or peak. What will be the expense of the outside painting at \$7.50 per square, the projection of the roof off-setting the openings for windows.

9. What will it cost to shingle a pitched-roof house 112 feet long, each side being 25 feet wide, at \$6.50 per M. ? On this roof there will be 51 courses to each side, including the double course at the eaves; the shingles are laid 6 inches to the weather. Each course will require 336 shingles, as one shingle usually lays 4 inches *running measurement*.

V.

1. *How many board-feet in 10 boards, each 16 feet long and 9 inches wide?*

2. *How many board-feet in 6 boards, 12 feet long, 10 inches wide?*

3. *Find the number of board-feet in 4 joists, 9 feet long, 8 inches wide and 3 inches thick?*

4. *Find the cost of 2 planks, each 10 feet long, 12 inches wide, and 3 inches thick at \$20 per M.?*

5. *Find the number of board-feet in 5 scantlings, 3 inches by 4 inches, 18 feet long?*

1. What costs a piece of rose-wood 4 feet long, 6 inches wide at 60 cents per board-foot?

2. How many feet in 20 boards, 14 feet long, 15 inches wide?

3. A carpenter bought a board 12 feet long, 16 inches wide at one end and 9 inches at the other end. He paid 3 cents a foot for it. What did it cost?

4. What will it cost to cover the four rectangular sides of a house, 56 feet long, 25 feet wide, and 22 feet high, with boards at \$15 per thousand? No allowance for waste.

5. To cover the floor of a gentleman's carriage-house it took 170 planks 16 feet long, 9 inches wide, and 2 inches thick. How much did the planks cost at \$12 per M.?

6. What will it cost for boards sufficient to build a fence $6\frac{1}{2}$ feet high, surrounding a circular half-mile race-course at \$15 per 1,000 feet?

7. Find the cost of 1,220 feet of boards at \$25.50 per M.; 2,000 feet of scantling at \$12 per M.; and 3,500 lath at \$3 per M.?

8. Find the cost of 36 boards, 12 feet long, 12 inches wide at \$25 per thousand; 16 planks, 14 feet long, 6 inches wide, 3 inches thick at \$16.25 per thousand?

9. How many feet of siding will it take to cover the rectangular sides and the two gables of a house, 40 feet long, 32 feet wide, and 22 feet high, allowing $\frac{1}{2}$ for waste in lapping, the altitude of the gables being 16 feet?

10. Make the following into bill form. A. K. Nelson, bought of Geo. B. Roe & Co., Flushing L. I., March 3, 1890.

124 boards, 10 in. by 16 ft.,	at	\$15	per M.;
120 boards, 16 in. by 14 ft.,	"	\$16.50	" " ;
40 planks, ($2\frac{1}{2}$ in. by 12 in.) by 15 ft.,	"	\$18.75	" " ;
96 joists, (3 in. by 10 in.) by 18 ft.,	"	\$14.00	" " ;
60 scantlings, (3 in. by 4 in.) by 12 ft.,	"	\$12.50	" " .

VI.

1. Find the cost of 6 boards, 12 feet long, 10 inches wide, at \$2.50 per hundred feet.

2. How many board-feet in 10 planks, 12 feet long, 15 inches wide, and 2 inches thick?

3. Find the number of board-feet in 6 scantlings, 3 in. by 4 in., and 16 feet long.

4. Find the contents of 10 posts, 6 in. by 8 in., and 12 feet long.

5. What is the cost of 10 joists, 12 feet long, 8 inches wide, and 3 inches thick, at \$10 per thousand feet?

1. How many board-feet of lumber in a sidewalk 300 feet long, 6 feet wide, the lumber being $1\frac{1}{2}$ inches thick?

2. What will it cost to build a board fence 40 rods long, 5 feet high, at \$12.50 per thousand feet?

3. Find the cost of lumber at \$12 per thousand feet for a platform 220 feet long, 132 feet wide, the planks being 2 inches thick.

4. A bridge 132 yards long and 16 feet wide is covered with planks $2\frac{1}{2}$ inches thick. How much did the planks cost at \$12.50 per thousand?

5. At \$16 per thousand feet, what will it cost to inclose a field 40 rods square, with a board fence, 7 boards high; the boards being 12 feet long, 9 inches wide?

6. Find the cost of 10 scantlings, 12 feet long, 4 inches wide, 2 inches thick; 15 planks, 12 feet long, 14 inches wide, 3 inches thick; 14 boards, 15 feet long, 12 inches wide, $1\frac{1}{4}$ inches thick, at \$16 per thousand feet?

7. At \$18 per thousand feet, what is the cost of 10 sticks of timber, 22 feet long, 8 inches by 4 inches?

8. My carriage-house is 36 feet by 40 feet. It is covered on the first floor with $1\frac{1}{2}$ inch plank, worth \$16 per M. The second floor with matched inch boards, worth \$18 per thousand feet. What is the cost of both floors, allowing $\frac{1}{8}$ for waste in matching the boards?

9. What will it cost to cover this carriage-house with hemlock boards at \$15 per M., including the roof, with a 2-foot projection at each of the two gables? The gables have an altitude of 15 feet from the base of the triangle to the ridge-pole, the apex of the triangle. The posts of this building are 20 feet, and the rafters 18 feet.

10. The following was the bill for the frame timbers for the carriage-house. What was the cost at \$15 per M.?
2 timbers 40 feet long, 6 in. by 8 in.; 10 timbers 36 feet long, 4 in. by 8 in.; 60 timbers 12 feet long, 2 in. by 7 in.; 60 timbers 12 feet long 2 in. by 5 in.; 40 rafters, 18 feet long, 2 in. by 5 in.; 10 posts 20 feet long 6 in. by 8 in.; 2 plates 40 feet long, 5 in. by 6 in.; 150 scantlings 20 feet long 2 in. by 4 in.

VII.

1. I have a wood-pile 16 feet long, 4 feet wide and 4 feet high. What is the value at \$5 a cord?

2. A broker's office is 20 feet long, 10 feet wide, and 15 feet high. How many cubic feet of air does it contain?

3. What will be the cost of 3 cubic yards of stone at 10 cents a cubic foot?

4. At 50 cents per cord-foot, how much will 3.5 cords of wood cost?

5. A builder bought 4 perch of stone at 10 cents a cubic foot. How much did he pay for the stone?

1. Find the value of a range of wood 60 yards long, 12 feet high at \$5.00 a cord, the length of the sticks being 4 feet.

2. My wood-house is 20 feet long, 18 feet wide, and 10 feet high. How many cords of wood can be piled in it ?

3. Find the value of a range of tan-bark, 120 feet long, 40 feet wide, and 16 feet high at \$5.50 per cord or ton.

4. What is the value of a range of wood, 18 feet long, 12 feet wide, and $10\frac{1}{2}$ feet high at \$4.75 per cord ?

5. What will it cost to dig a cellar 30 feet long, 24 feet wide, and $5\frac{1}{2}$ feet deep at 20 cents per cubic yard ?

6. How many bricks, ordinary size (8 in. by 4 in. by 2 in.), will be required to build the four walls of a school-house 72 feet long, 54 feet wide, and 30 feet high, outside measurements, the walls being 1 foot thick ? Allow for the mortar in laying them.

7. What is the value of a pile of ordinary bricks, 20 feet long, $6\frac{1}{2}$ feet high, 18 feet wide at \$7.50 per M. ?

8. At 40 cents a cubic yard, what will it cost to dig a ditch 120 yards long, 3 feet wide, and $2\frac{1}{2}$ feet deep ?

9. What will be the cost of 8 perch of stone at 11 cents a cubic foot ?

10. Put the following in bill form, and find the amount at \$16 per M. :

26 boards, 12 feet long, 16 inches wide ; 20 planks, 16 feet long, 9 inches wide, 2 inches thick ; 28 scantlings, 18 feet long, 4 inches by 3 inches. ; 25 boards, 16 feet long, 16 inches wide, $1\frac{1}{4}$ inches thick ; 150 joists, 16 feet long, 9 inches by $2\frac{1}{2}$ inches, and 30 planks, 14 feet long, 18 inches wide, 3 inches thick.

VIII.

1. Find the cost of a block of granite 4 feet long, 3 feet wide and 2.5 feet thick at \$2.50 per cubic foot.

2. What will it cost to dig a pit 6 feet deep, and 3 feet square at \$1.00 per cubic yard?

3. If a box 1 foot square holds 7.5 gallons of water, how many gallons in a box 6 feet long, 3 feet wide, and 5 feet deep?

4. How many cords in a range of wood, 32 feet long, 4 feet high, and 4 feet wide?

5. How many feet of space in a tank, 4 feet deep, and 2 feet square at the bottom?

1. How many gallons will a box hold which is 5 feet long, 3 feet wide, and 4 feet deep?

Exact Method.

$$5 \times 3 \times 4 \times \frac{1}{2} = 448.8 + \text{gal.}$$

Practical Method.

$$5 \times 3 \times 4 \times 7\frac{1}{2} = 450 \text{ gal.}$$

2. How many bushels of corn will a box hold which is 6 feet long, 5 feet wide, and 4 feet deep?

Exact Method.

$$6 \times 5 \times 4 \times \frac{1}{4} = 96.42 \text{ bu.}$$

Practical Method.

$$6 \times 5 \times 4 \div 4 = 96 \text{ bu.}$$

3. Find the number of gallons in a tank 3 feet 6 inches long, 2 feet 4 inches wide, and 3 feet 9 inches deep.

4. A cubic foot of ice weighs 58 pounds, how many tons can I store in my ice-house, which is 30 feet long, 24 feet wide, and 20 feet high?

5. How many bushels will a bin hold, which is 9 feet long, 5 feet wide, and 3 feet deep?
6. At 90 cents a bushel, what will be the cost of the wheat contained in a bin 30 feet long, 24 feet wide, and 18 feet deep?
7. If the fall of rain is 4 inches in 24 hours, how many gallons will a cistern receive from a roof 32 feet by 90 feet, practical measurement?
8. How many barrels of water in a cylindrical tank, 10 feet in diameter, and 12 feet deep?
9. Dr. Bleecker had constructed in his carriage-house a cistern, 10 feet in diameter and $4\frac{1}{2}$ feet deep. How many gallons of water does it hold when full?
10. A cistern 8 feet deep, and 6 feet square at the top and bottom, will hold how many gallons, exact measurements?

IX.

1. How many cubic feet in a box of sugar 5 feet long, 3 feet wide, and 3 feet deep?
2. How many cubic feet in a load of wood 7 feet long, 4 feet wide, and 5 feet high?
3. At 6 cents a quart, how many bushels of beans can be bought for \$2.88?
4. How many acres in a piece of land 80 rods long, and 40 rods wide?
5. In a block of marble 6 feet long, and 3 feet square at each end, how many cubic yards?

1. Allowing .8 of a bushel to a cubic foot, how many bushels of rye can be put into a bin, the inside measurement of which is 16 feet long, 12 feet wide, and 6 feet deep ?

2. Allowing $7\frac{1}{2}$ gallons to a cubic foot, how much will a tank hold, the inside measurement of which is 5 feet long and 4 feet square at each end ?

3. How much will a range of wood 70 feet long, 4 feet wide, and 14 feet high cost at \$4.50 per cord ?

4. Lehigh stove-coal weighs 50 pounds to the cubic foot; how many short-tons will a bin hold, which is 8 feet long, 5 feet wide, and 4 feet deep ?

5. Lackawanna stove-coal weighs 45 pounds to the cubic foot, how many tons of 2,000 pounds each, will a bin hold, which is 16 feet long, 4 feet wide, and 10 feet high ?

6. What will it cost to excavate a cellar, 64 feet long, 46 feet wide, and 12 feet deep at 25 cents per cubic yard ?

7. Allowing 21 bricks to the cubic foot, how many bricks will it take to build a house, 40 feet long, 32 feet wide, and 25 feet high, *outside measurement*, the walls being 1 foot thick ? No allowance for apertures.

8. A rectangular bin is 10 feet long, 6 feet wide, and 4 feet deep. What are the contents in bushels, exact measurement ?

9. Allowing 58.1 pounds to the cubic foot, how many tons of ice can be cut from a pond 10 rods by 4 rods, the ice being 1 foot thick ?

10. At \$7.50 a perch, what will it cost to build a stone wall, 8 feet high, $4\frac{1}{2}$ feet thick, enclosing a garden 13 rods long, and 9 rods wide, *outside measurement* ?

X.

1. How much will 8 oz. 5 pwt. of gold dust cost at \$1.00 an ounce?

2. At 3 cents a pint, how much milk can be bought for \$1.05?

3. A range of wood is 16 feet long, 8 feet high, and 8 feet wide. How much is it worth at \$3.50 a cord?

4. How much will a village lot, 120 feet deep with a 25 foot frontage cost at 6 cents a square foot?

5. How much will it cost to dig a cellar 24 feet long, 20 feet wide, and 3 feet deep at 5 cents a cubic foot?

1. If a bushel of wheat equals $1\frac{1}{2}$ cubic feet of space, how many cubic feet will 200 bushels occupy?

2. If a cubic foot of space holds $7\frac{1}{2}$ gallons, how deep is the milk in a 4-foot square vat, which contains 120 gallons?

3. Find the cost of digging a cellar 60 feet long, 25 feet wide, and $6\frac{1}{4}$ feet deep at 36 cents a cubic yard.

4. Find the cost of sodding $\frac{1}{4}$ of an acre of ground at 25 cents a square yard.

5. What will it cost at \$9 per thousand feet, to fence a field 40 rods by 60 rods, using one 12-inch board and five 6-inch boards to each panel, the boards running lengthwise?

6. How many loads, or cubic yards of macadam, will be required for a road 3 miles long, if it is spread 9 feet wide and 8 inches deep?

7. How many bricks will make a wall 45 feet long, 25 feet high, and $2\frac{1}{2}$ feet thick?

8. How many perch of stone in a wall, "dry laid," 120 feet long, $33\frac{1}{2}$ feet high, and 11 feet thick?

9. How many bushels of oats will be contained in a bin, 9 feet long, 4 feet wide, $3\frac{3}{4}$ feet high, inside measurement?

10. A man built a tank in the attic of his house, 10 feet long, 6 feet wide, 4 feet deep. How many tons of water will it hold, a cubic foot of water weighing $62\frac{1}{2}$ pounds?

COMPOUND DENOMINATE NUMBERS.

I.

- 1. If an ounce of silver cost \$1.20, what will 1 pound cost?*
 - 2. What will 2 scruples of quinine cost at one-half cent a grain?*
 - 3. How many boxes will it take to hold 3 pounds of pepper, each box holding 4 ounces?*
 - 4. What part of a bushel are 3 pecks and 7 quarts?*
 - 5. A boy sold 2 gallons, 2 quarts of milk at 4 cents a pint. How much did he receive for it?*
-
1. How many bottles each holding 3 pints, will it take to bottle 3 gal. 3 qt. 1 pt. of blackberry wine?
 2. A farmer has 6 bu. 3 pk. 4 qt. of beans in bags, holding 4 quarts each. How many bags are there?
 3. In 61 pints of molasses how many gallons, quarts and pints?
 4. How many hhd. gal. and qt. in 1,896 pints of molasses?
 5. A grocer bought 21 bu. 3 pk. 5 qt. 1 pt. of sweet potatoes for \$21.50, and retailed them at 5 cents a quart. How much did he make?
 6. How many spoons, each weighing 2 oz. 12 pwt. can be made from 8 lb. 2 oz. 16 pwt. of silver?
 7. What will 2 T. 12 cwt. of coal cost at \$4.50 per ton?

8. How many rods of fence will enclose a section of land ?

9. A gentleman purchased a farm half a mile square at \$50 an acre. What was the cost ?

10. At \$1.70 a perch, what would 2,376 cubic feet of stone cost ?

II.

1. How many cubic feet in 3.5 cubic yards ?

2. How many square rods in .75 of an acre ?

3. What part of 6 feet square is 6 square feet ?

4. How many rods in 2 miles and 40 rods of fencing ?

5. A horse is 16 hands high. What is his height in feet ?

1. In .9 of a foot how many inches ?

2. In $\frac{3}{4}$ of a gallon of cider, how many pints ?

3. Reduce 6 gal. 3 qt. 1 pt. to pints.

4. How many pints are there in $\frac{1}{2}$ -bushel of nuts ?

5. How many gills are there in $\frac{3}{4}$ of a gallon of wine ?

6. How many feet and inches in $\frac{3}{4}$ of a yard ?

7. In .75 of a yard, how many feet and inches ?

8. At \$5.50 a rod, how many miles of road can be built for \$6,352.50 ?

9. A gardener sold 2 bu. 3 pk. 4 qt. of green peas at 30 cents per peck. How much did he receive for them ?

10. What will be the cost of 3,720 pounds of oats (32 pounds to the bushel) at 28 cents per bushel ?

III.

1. If 5 pounds of butter cost \$1.50, what will 2 pounds 6 ounces cost?

2. A grocer buys a barrel of pork for \$24, and sells the whole at 15 cents a pound. How much did he make?

3. What will a mile of barbed wire cost at three-fourths cents per foot?

4. Find the cost of 15 square yards of oil-cloth at 20 cents a square foot.

5. A boy bought a gross of penholders for \$1.00, and sold them at a cent each. How much did he make?

1. In 884 pints of chestnuts, how many bushels, pecks and quarts?

2. Change 28 rd. 4 yd. 2 ft. 10 in., into inches.

3. Change .3 of a quart to the decimal of a pint.

4. Change .06 of a bushel to the decimal of a peck.

5. One twenty-fourth of a foot is what fractional part of an inch?

6. Two-thirds of a foot of lace is what fractional part of a yard?

7. Three-fourths of a hundred-weight of hay is what decimal part of a ton?

8. Change 16 rods to the decimal of one mile.

9. Change 10,728 sheets of paper into ream and quire packages.

10. Change 3.25 pounds of coal to the decimal of a ton.

IV.

1. *How many hours in the month of September?*
2. *How many months in 2.5 years and 3 months?*
3. *In two-thirds of a yard of gimp, how many inches?*
4. *What decimal part of a bushel are 2.5 pecks of potatoes?*
5. *A boy bought .75 of a peck of chestnuts, and sold them at 5 cents a pint. How much did he receive for them?*

-
1. Change 40 square rods to square feet.
 2. How many bushels and pecks in 640 quarts of peas?
 3. Change $\frac{3}{4}$ of a gallon to quarts and pints. } Add.
Change .375 of a gallon to quarts and pints.
 4. Change $\frac{1}{4}$ of a mile to rods and yards.
 5. Change .78875 T. to hundred-weights, pounds and ounces.

6. Three-fifths of an ounce of silver is what fractional part of a Troy pound?

7. Change 103.75 feet to rods, feet and inches. } Add.
Change .845 miles to rods, yards, ft. and in.

8. How much will .8 bushels, 6.5 quarts of peanuts, 3 gallons 2.5 quarts of molasses, and 3.25 bushels of chestnuts cost at 10 cents a quart?

9. A milkman bought 874 gallons of milk at 18 cents a gallon. He sold $\frac{1}{2}$ of it at 20 cents a gallon; the remainder he served to customers at six cents a quart. How much did he make on the whole purchase?

10. A man purchased 3 tons 17 hundred-weight of hay at 50 cents per hundred-weight; 5 hundred-weight 85 pounds of corn-meal at 1.5 cents a pound; 2 pounds 4 ounces of indigo at 10 cents an ounce. What was the amount of his bill?

V.

1. Half a peck of oats is what part of a bushel?
2. What decimal part of a gallon is 2 quarts and 1 pint?
3. How many pounds are there in 56 ounces of candy?
4. What decimal part of a barrel of flour is 784 ounces?
5. From 1 bushel of clover-seed, a farmer used 3 pecks and 5 quarts. What part of the bushel had he left?

1. What decimal part of a bushel is 3 pecks and 2 quarts?

2. What fractional part of a bushel is 3 pecks and 2 quarts?

3. What fractional part of a week is 5 days, 14 hours, 24 minutes?

4. Change $\frac{3}{4}$ of a week to days, hours and minutes?

5. What is the value of .0055 ton of meal at 3 cents a pound?

6. What decimal part of a bushel is 3 pecks 1.12 quarts?

7. From $\frac{1}{2}$ rod take .75 of a foot. What is the difference?

8. Change 3 pecks, 7 quarts, 1 pint to the decimal of a bushel.

9. A child born January 11, 1890, died April 7, 1890. How many days old was it?

10. Find the sum of $\frac{1}{12}$ of a day, $\frac{2}{3}$ of $\frac{1}{2}$ of an hour, and $\frac{1}{12}$ of a minute.

VI.

Change to Whole Numbers of lower denominations.

- | | | |
|----------------------------|----------------------------|-------------------------|
| 1. 0.625 ton. | 4. $\frac{7}{8}$ peck. | 7. 0.1188 ton. |
| 2. 0.31 bushel. | 5. $\frac{5}{8}$ barrel. | 8. 0.125 sq. yd. |
| 3. $\frac{7}{8}$ cu. yard. | 6. $\frac{3}{8}$ lb. Troy. | 9. $\frac{1}{2}$ gross. |

- | | | |
|-------------------------|---------------------------|--------------------|
| 10. $\frac{3}{4}$ yard. | 12. $\frac{2}{3}$ bushel. | 14. 1.375 gallons. |
| 11. .018 mile. | 13. $\frac{1}{12}$ mile. | 15. 0.875 rod. |

VII.

1. If 6 barrels of flour cost \$33, what will 4 barrels cost?
2. If two-thirds of a barrel of flour cost \$4.20, what will 7 barrels cost?
3. If .5 of a pound of tea cost \$.25, what will 1.5 pounds cost?
4. How many board-feet in a board 16 feet long, and 13 inches at one end, tapering to 5 inches at the other end?
5. How many cubic feet of air in a box 4 feet long, 2.5 feet wide, and 18 inches deep?

1. Find the cost of 7 gal. 3 qt. 1 pt. of oil at 15 cents a gallon.

2. What decimal part of November has passed at the beginning of the 25th day of that month?

3. A farmer raised 23 bu. 2 pk. 5 qt. of beans, and sold them at \$3.25 a bushel. How much did he receive?

4. What is the cost of a load of hay, weighing 1,875 pounds at \$12.50 per ton?

5. What is the cost of 3 gal. 3 qt. 5 pt. of machine oil at \$1.87 $\frac{1}{2}$ per gallon?

6. How much is a load of oats weighing 1,328 pounds worth at 40 cents per bushel, if they weigh 32 pounds to the bushel?

7. What cost 5 T. 7 cwt. 24 lb. of hay at \$16 a ton?

8. If sweet potatoes are selling at \$1.28 a bushel, what will 3 bu. 2 pk. 5 qt. cost?

9. At \$ $\frac{1}{2}$ a foot what is the cost of 7 rods, 2 yards, 1 $\frac{1}{2}$ feet of lead pipe?

10. A milkman buys milk at 4 cents a quart, and sells it at 28 cents a gallon. Find his gain on 37 gallons, 3 quarts, 1 pint.

VIII.

1. If 12 dozen of buttons are worth \$1.08, what is the value of 9 buttons?

2. How much heavier is a pound of shot than a pound of feathers?

3. At 10 cents a square rod how much will 1 acre of land cost?

4. How many quarter-sections of land in a township 6 miles square?

5. How many cubic feet in 2 perches of stone-wall?

1. How many cords in a range of wood 40 feet long, 4 feet wide and 6 feet high?

2. In a block of marble 6 feet long, 4 feet wide and $1\frac{1}{2}$ feet thick, how many surface feet?

3. How much will it cost to build a stone-wall 20 feet long, 6 feet high and 3 feet wide at \$1.21 per perch?

4. What will it cost to dig a cellar 60 feet long, 40 feet wide, $4\frac{1}{2}$ feet deep at \$.62 $\frac{1}{2}$ per cubic yard?

5. At \$3.50 a cord what is the value of a range of wood, 64 feet long, 4 feet wide and 14 feet high?

6. How much will 8 bu. 2 pk. 2 qt. 1 pt. of peanuts bring if sold at 5 cents a pint?

7. A man retails linseed oil at 12 cents a pint, that cost him 60 cents a gallon. How much does he make on 36 gallons, 3 quarts?

8. What will a ton of coal cost at $\frac{1}{2}$ cent a pound, and a ton of hay at 85 cents per hundred-weight?

9. At 22 cents a pound what will be the cost of 3 hundred-weight, 71 pounds of coffee?

10. A man was born February 8, 1825, and died October 6, 1890. How old was he?

IX.

1. What will two-thirds of a yard, and three-fourths of a foot of gimp cost at 4 cents a foot?

2. What will be the cost of three-fourths of a pound, and three-fourths of an ounce of candy at 20 cents a pound?

3. When pears are worth \$.75 a bushel, what is 1 peck worth?

4. In a block of marble 8.5 feet long, and 4 feet square at each end, how many cubic feet?

5. How many days in the winter months of 1892?

1. Add 37 bu. 1 pk. 3 qt.; 41 bu. 2 pk. 5 qt.; 35 bu. 1 pk. 3 qt.; 43 bu. 3 pk. 1 qt.; 3 pk. 7 qt.

2. Add 4 oz. 15 pwt. 12 gr.; 3 oz. 10 pwt. 17 gr.; 11 oz. 14 pwt. 16 gr.; 8 oz. 10 pwt. 15 gr.

3. Add 7 cwt. 14 lb.; 3 tons, 20 lb.; 2 tons, 3 cwt. 17 lb.; 5 tons, 17 cwt. 14 lb.; 11 tons, 15 cwt. 38 lb.

4. Add 2 mi. 180 rd. 5 yd. 2 ft.; 3 mi. 72 rds. 3 yd. 1 ft.; 8 mi. 300 rd. 5 yd. 2 ft.; 18 rd. 5 yd. 2 ft.

5. Find how much kerosene is contained in 4 barrels. The first contains 43 gal. 2 qt. $1\frac{1}{2}$ pt.; the second 40 gal. 3 qt. 1.75 pt.; the third 42 gal. 1 pt. 3 gi.; the fourth 41 gal. 2 qt. 2 gi.

6. Washington was born Feb. 22, 1732. How old was he July 4, 1776?

ILLUSTRATIVE.

yr.	mo.	da.
1776	7	4
1732	2	22
<hr/>		
44	4	12

ANALYSIS.

Represent July, the seventh month, by 7, and Feb., the second month of the year, by 2. Thirty days allowed to the month.

7. What is the difference of time between October 16, 1869 and August 2, 1883 ?

8. The American Independence was declared July 4, 1776. How long to the present date, Oct. 29th, 1890 ?

9. A grocer bought a cask of oil containing $51\frac{1}{2}$ gal. $2\frac{1}{2}$ qt. and $1\frac{1}{2}$ pt. The dealer said it contained 63 gal. How much had leaked out ?

10. The latitude of St. Louis is $38^{\circ} 27' 28''$ North, and Cape Horn, $55^{\circ} 58' 40''$ South. What is the difference of their latitude ?

X.

1. *What is the age of a person who is "three score and ten" years old ?*

2. *At 10 cents a pint, how much molasses can be bought for \$2.30 ?*

3. *A lake of water measures 4 fathoms 1 foot in depth. How many inches deep is it ?*

4. *What will 10 reams of paper cost at 20 cents a quire ?*

5. *What will .5 of five-eighths of a barrel of flour cost at 4 cents a pound ?*

1. Find the weight of 37 pieces of silver, averaging 6 lb. 2 oz. 7 pwt. 18 gr.

2. Multiply 15 yd. 1 ft. by 21, and 13 yd. 2 ft. 4 in. by 9. Add the results.

3. Multiply 5 cwt. 2 qr. 16 lb. by 7, and 1 cwt. 3 qr. 19 lb. 13 oz. by 14. Subtract the results.

4. Multiply 5 bu. 3 pk. 6 qt. $1\frac{1}{2}$ pt. by 6, 8, 12, 14, and add the products.

5. Multiply 3 rd. 1 yd. 1 ft. 8 in. by 15. From the results subtract 16 rd. 2 ft. 10 in.

6. Divide 84 miles, 37 rods, 5 yards by 9.
7. Divide 9 hhd. 56 gal. 2qt. by 12, and 169 gal. 3 qt. 1 pt. by 36. Subtract the results.
8. During the month of February, 1888, a grocer sold 3 T. 16 cwt. 2 lb. 8 oz. of butter. What was his average daily sale?
9. Find $\frac{4}{5}$ of 188 bu. 3 pk. 3 qt. 1 pt.
10. Divide 12 lb. 11 oz. 7 gr. 2 scrup. 19 dr. by 11, and 21 lb. 2 oz. 6 gr. by 17. Add the results.

TEST REVIEW.

I.

1. John earns \$8.50 a week, and it costs him \$2.50 for board during that time. How much will he save in 5.5 weeks?

2. Thomas and Henry have \$4.50. Thomas has \$1.50 more than Henry. How much has each?

3. At 5.25 cents a yard, what will 40 yards of calico cost?

4. A farmer paid 75 cents apiece for 20 hens, and \$18.75 for 10 turkeys. How much more did he pay for the turkeys than the hens?

5. A man bought 42 gallons of oil for \$16. After one-seventh leaked out he sold the remainder at \$.50 a gallon. What was his gain?

1. How much land in a farm having 16.625 acres of woodland, 47 acres of meadow, and 58.375 acres of pasture-land?

2. A watch cost \$49.75, a chain \$15.25. What would be the loss if both were sold for \$57.25?

3. William and Arthur have \$18.40. William has \$1.20 more than Arthur. How much has each?

4. A speculator bought a farm for \$3750, and a city lot for \$1675.75. How much did he make if he sold both for \$5600?

5. How many feet in 108.375 miles, there being 5280 feet in 1 mile?

6. At \$.70½ a yard, what will 20.4 yards of silk cost?

7. Joseph weighs 13.625 pounds less than his brother James, who weighs 105 pounds. What is the weight of both?

8. A drover paid \$3.00 apiece for 3008 sheep, and \$7728 for cows. How much more did he pay for the sheep than the cows?

9. A speculator bought 89.764 gallons of kerosene at $9\frac{1}{2}$ cents a gallon. He sold $\frac{3}{4}$ of it at 19 cents per gallon, and the remainder at 15 cents a gallon. How much money did he make?

10. A grocer bought 840 bushels of potatoes at 60 cents a bushel, and 640 bushels at 70 cents a bushel. He sold $\frac{1}{4}$ of them at \$.80 a bushel, $\frac{1}{2}$ of the remainder at \$.84 cents a bushel, and what he then had left at 65 cents a bushel. What did he gain?

II.

1. A farmer bought 6 sheep at \$7 per head, and sold them for \$54. How much was his gain on each sheep?

2. What will a barrel of vinegar cost at 20 cents a gallon?

3. How many bushels of potatoes at \$.625 per bushel can be bought for \$25?

4. John has \$5.50, Joseph \$4.25, William \$.75. How much money have all?

5. Mr. Brown has 40 cows, which is four-fifths of the number Mr. Ford has. How many have both?

1. A farmer bought 154 acres of land at \$64 per acre, and sold the whole for \$11,704. How much was his gain per acre?

2. What will a cask of molasses containing 52.25 gallons cost at \$0.45 $\frac{1}{2}$ per gallon?

3. How many barrels of apples at the rate of \$1.18 a barrel can be bought for \$47.50?

4. A merchant bought a piece of dress goods containing 42 yards for \$10.14. At what price per yard must he sell it to make 12 cents on each yard?

5. If 3 pairs of stockings cost \$1.41, what will 7 pairs cost?

6. How many bushels of wheat at \$1.75 per bushel will pay for 3 hundred-weight of pork at 7 cents per pound?

7. How many bushels of oats can be raised on 4.5 acres, if each acre produces 1528 pounds?

8. An agent paid \$2.25 a day for 15 days' board, \$27½ for railroad fares, and had \$37.75 left. How much had he at starting?

9. A grocer bought 192 pounds of rice at \$.07 a pound, and 364 pounds of sugar at \$.06 a pound. Find the cost of both.

10. A dealer bought 40 tons of hay at \$10 a ton; 36 tons at \$8 a ton, and sold all at \$.75 a hundred-weight. What was his gain?

III.

1. If \$27 will buy nine lambs, how many lambs will two-thirds of that amount purchase?

2. A grocer bought 10 pounds 4 ounces of butter at 24 cents a pound, and sold it all for \$3. How much did he make?

3. A farmer sold 6 barrels of apples each containing 2.5 bushels. What did he receive for them at \$.50 a bushel?

4. If .75 bushel of corn cost \$.45, what will 5.5 bushels cost?

5. How many times will the wheel of a carriage 16.5 feet in circumference turn in going 2 miles?

1. If \$54 will purchase 9 barrels of flour, how many barrels will \$186 buy?

2. A grocer bought 15 pounds 4 ounces of butter at 37 cents a pound, and sold the lot for \$7.22. How much was his profit?

3. A brewer bought 112 bags of malt each containing 2.5 bushels. What was their cost at 80 cents a bushel?

4. If 4 bushels of wheat are required for a barrel of flour, how many barrels of flour can be made from 47.25 bushels?

5. If .125 of a bushel of wheat cost \$0.16, what will a bushel cost?

6. When cloth is \$2.25 a yard, how many yards will \$3.37 buy?

7. A farmer exchanged a number of barrels of apples and potatoes, worth respectively \$3.75 and \$7.50, for cloth at \$1.25 a yard. How many yards did he get?

8. A man paid \$4260.20 for a farm of 68 acres, and sold it at a loss of \$204. How much per acre did he receive for it?

9. How many times will the wheel of a carriage 17.5 feet in circumference, revolve in going 1 mile and 5 feet?

10. At \$5.60 for $\frac{1}{4}$ of a barrel of flour, what should I pay for 2 barrels and 49 pounds?

IV.

1. At \$3.60 for .75 of a barrel of flour, what will I pay for 49 pounds?

2. A man sold one half ton of pork for \$100, for which he paid \$16 a barrel. How much did he make?

3. A boy bought 1 bushel 3 pecks of chestnuts for \$2.40, and retailed them at 10 cents a quart. What was his gain?

4. A drover bought 14 lambs for \$42. For how much must he sell them apiece to gain \$21?

5. Andrew found \$.75, and gave two-fifths of it to his brother. What part of a dollar had Andrew left?

1. A man sold at 14 cents a pound 16 hundred-weight of cheese, for which he paid \$10 a hundred-weight. How much did he make?

2. A boy bought 7 bushels, 3 pecks of peanuts at \$2.40 a bushel, and retailed them at 10 cents a quart. What was his gain?

3. A drover bought 140 calves for \$700. For how much must he sell them per head to gain \$84?

4. How many bags each holding 2.25 bushels, will be required to hold 2700 bushels of wheat?

5. A man bought 640 cords of wood at \$3.87 per cord, and sold it at \$4.48 a cord. How much did he make?

6. How many barrels of flour worth 5 cents a pound, can be bought for 49 gross of eggs at 20 cents per dozen?

7. If .125 gallon of oil cost 2 cents, what will 52 gallons cost?

8. What is the cost of 10 gallons 3 quarts of milk at 4 cents a pint?

9. A grocer bought a barrel of vinegar at \$9.45 per barrel. For how much must he sell it per gallon to gain \$6.30 on the whole?

10. If 16 tons of steel bars cost \$800, what will 15 hundred-weight cost?

V.

1. How many rods of fence will be required to enclose a quarter-section of land?

2. A farmer sold three-eighths of a bushel of cranberries for \$3.84. What was that a bushel?

3. From a pile of wood containing 7 cords, a man sold .5 of it for \$14. How much was that per cord?

4. If 2 bushels of wheat make 98 pounds of flour, how many barrels will 20 bushels make?

5. At 25 cents a pound what will one ton of butter cost?

1. How many rods of fence will be required to enclose a section of land?

2. If 32 acres of land are worth \$1600, what would be the value of 80 square rods of it?

3. A miller bought 648 bushels of rye at 80 cents a bushel. He sold $\frac{1}{4}$ of it at 85 cents a bushel and $\frac{1}{3}$ of the remainder at 90 cents a bushel, the balance at 75 cents a bushel. What was his gain?

4. A man buys a farm of 226 acres at \$27 an acre. He pays \$1392 cash and agrees to pay the balance in 6 equal annual payments. How much must he pay yearly?

5. A teamster draws 1.125 cords of wood at a load. How many loads will $4\frac{1}{3}$ cords make?

6. At \$7 $\frac{1}{4}$ per bushel, how many bushels of clover-seed can be bought for \$66.93 $\frac{1}{4}$?

7. If 5 tons of coal are equal to 9 cords of wood for fuel how much would a family, that burns 31.5 cords of wood each year, save if they exchanged the wood for coal, when wood is worth \$4.25 per cord, and coal \$6.80 per ton?

8. If 1 bushel of wheat makes 49 pounds of flour, how many barrels will 500 bushels make?

9. At 22 cents a pound, what will be the cost of 1 ton 3 cwt. 21 lb. of coffee?

10. A grocer bought four barrels of cider at \$4 a barrel and after converting it into vinegar retailed it at 30 cents a gallon. What was his entire gain?

VI.

1. A boy sold 12 ducks for \$15, and made \$6. How much did he pay apiece for them?

2. A milkman having 14.75 gallons of milk, sold all but 10 quarts. How much did he sell?

3. How many square feet in a rug 8 feet by 4.5 feet?

4. At one-half dime a pint how much molasses can you purchase for 95 cents?

5. A barrel of pork sold for \$24, which was 1.5 times its first cost. What was its first cost?

1. A man sold 563 horses for \$73,190, and made \$8445. How much did he pay apiece for them?

2. A butcher bought 6 quarters of beef, each weighing 2 cwt. 17 lbs. 8 oz. at 8 cents a pound. What was the amount of the bill?

3. What will $\frac{3}{4}$ of a hundred-weight of sugar cost at $6\frac{1}{2}$ cents a pound?

4. At \$1.12 $\frac{1}{2}$ per bushel, how many bushels of wheat can be bought for \$523.75?

5. At \$4.06 $\frac{1}{2}$ per barrel, how many barrels of flour can be purchased for \$1023.75?

6. If 25 barrels of flour cost \$112.50, how much would 98 pounds cost?

7. During the year 1890 a farmer sells produce and stock to the amount of \$9237. He paid for repairing his house \$136, for hired help on his farm four times as much, lacking \$95, and for other expenses \$1902. How much does he lay up annually?

8. A farmer bought 145 acres of land for \$4930, and sold a part of it at \$40 an acre, receiving \$5000. How much did he gain on each acre sold?

9. If 37 hogsheads of molasses cost \$1278, for how much must it be sold per gallon to gain \$120.25?

10. A merchant bought 17 pieces of cloth for \$391; but it being damaged he was obliged to sell it for \$71.91 less than it cost. What was his selling-price per piece?

VII.

1. At \$3 a barrel how much will 3.5 barrels of potatoes cost?

2. A man bought 5 gross of lead pencils for \$10, and re-tailed them at 25 cents a dozen. What was his gain?

3. My garden is in the shape of a rectangle 10.5 rods long and 8.25 rods wide. What is the distance around it?

4. Find the cost of two-thirds of a yard of cloth at \$.75 a yard?

5. A farmer paid \$40 for a cow and calf. The cow cost \$24 more than the calf. What was the cost of the calf?

1. A farmer having 207 sheep bought 65 more, and then sold all at \$7 a head. What was the amount gained per head if the entire lot cost him \$1768?

2. Two men hired a pasture together for \$240. One put in 25 cows and the other 23 cows. How much of the rental should each pay?

3. At \$2 $\frac{1}{2}$ a cord how much will 9 $\frac{3}{4}$ cords of wood cost?

4. At $\frac{2}{3}$ of a dollar a bushel what will $\frac{3}{4}$ of a bushel of wheat cost?

5. At $\$3\frac{1}{2}$ a bushel how much corn can be bought for $\$8$.

6. A man paid $\$87.90$ for a horse and $\$25\frac{1}{2}$ for a cow. How much more was paid for the horse than the cow?

7. If a barrel of sugar is worth $\$22$, what is $.7$ of it worth?

8. My farm is in the shape of a rectangle, $\frac{7}{8}$ mile long and $\frac{1}{5}$ mile wide. What is the distance around it?

9. Find the cost of $\frac{1}{4}$ of a yard of silk at $\$1\frac{1}{6}$ a yard?

10. A man sold 12 bushels 3 pecks of cranberries at $\$2.80$ a bushel, and took his pay in flour at 4 cents a pound. How many barrels did he receive?

VIII.

1. A dealer sold 15 hundred-weight of coal for $\$3.45$. How much was that per ton?

2. What will 2.5 pounds of cheese cost, if 1.5 pounds cost 18 cents?

3. From a ten-gallon can of milk 34 quarts were sold. How much remained?

4. At 2 dimes a peck how many bushels of apples can be bought for $\$16$?

5. What will 5 lbs. 12 oz. of sugar cost at 4 cents a pound?

1. A paper manufacturer paid $\$46.25$ for 1480 pounds of linen rags. How much was the price per ton?

2. What will 5 pounds 4 ounces of butter cost if $1\frac{1}{2}$ pounds cost 36 cents?

3. What cost 7 barrels of sugar, 340 pounds each, at $4\frac{1}{2}$ cents per pound?

4. From a barrel ($31\frac{1}{2}$ gal.) of vinegar, $28\frac{1}{2}$ gallons were taken. How much remained?

5. At $\$4\frac{3}{4}$ a barrel how many barrels of flour can you purchase with $\$24.75$?

6. At $\$2\frac{1}{2}$ a yard how much broadcloth can be bought for $\$18\frac{7}{8}$?

7. If one pound of rice is worth $5\frac{1}{2}$ cents, how many pounds can be bought for $\$1.47$?

8. What will $5\frac{3}{4}$ pounds of sugar cost at $4\frac{5}{8}$ cents a pound?

9. How many pounds of tea at $\$1\frac{1}{2}$ a pound can be had for $\$13.50$?

10. What is the cost of 7 quarts of potatoes if 2 bu. 2 pk. 4 qt. cost $\$2.52$?

IX.

1. What is the price of one bushel of potatoes if 2 bushels and 3 pecks cost $\$2.20$?

2. What part of an acre is a lot which is 10 rods long and 8 rods wide?

3. How much must you add to 2 and five-eighths dollars to make $\$5.375$?

4. At three-eighths of a dollar a yard what will be the cost of 40 yards of straw matting?

5. At 1 cent a pound how many bushels of wheat can be purchased for $\$120$?

1. What number of dollars must you add to $\$4\frac{5}{8}$, to make $\$16.37\frac{1}{2}$?

2. Find the difference between $\$2\frac{2}{3}$ added to $\$2\frac{3}{5}$ and $\frac{2}{3}$ of $\$1\frac{2}{3}$.

3. A rectangular lot is 4 rods wide and 15 rods long. What part of an acre is it?

4. How much will 3300 pounds of wheat cost at \$1.20 per bushel?

5. If a cabinet-maker pays $\$1\frac{1}{7}$ as a royalty on every invalid chair he sells, how many must he sell to pay the inventor of the patent $\$27\frac{3}{4}$?

6. A grocer paid \$8.68 for $108\frac{1}{2}$ pounds of beef, and sold it at 15 cents per pound. How much was his profit?

7. At $\$3\frac{1}{2}$ a yard what will be the cost of $40\frac{3}{4}$ yards of flannel?

8. A boy had $\$11\frac{3}{4}$ after spending $\$8.37\frac{1}{2}$ for a suit of clothes. How much money had he at first?

9. At \$0.40 per bushel how many pounds of oats may be purchased for \$132?

10. How much sugar at $4\frac{1}{2}$ cents a pound must be given for $6\frac{1}{2}$ hundred-weight of wheat at \$0.90 a bushel?

X.

1. At \$0.75 a pair how many pairs of chickens could be had for \$4.50?

2. What is a ten-gallon can of milk worth at 5 cents a quart?

3. What will 25 bricks cost at \$8 per thousand?

4. If three-eighths of a barrel of flour is worth \$2.40, what is one-half of a barrel worth?

5. A stationer, by selling paper at a gain of 5 cents a quire, made \$4.50. How many reams did he sell?

1. A stationer bought 10 gross of pens at 45 cents per gross and retailed them at 2 for a cent. How much was his gain?

2. At $\$1.62\frac{1}{2}$ a pair how many pairs of shoes could be bought for \$292.50?

3. What will 18500 bricks cost at \$8.40 per thousand?
4. At \$ $\frac{5}{8}$ a yard how many yards of cloth can be bought for \$21.75?
5. If $\frac{7}{8}$ of a barrel of flour is worth \$5.60, what are $3\frac{1}{4}$ barrels worth?
6. A merchant sold goods for \$924 and thereby lost $\frac{3}{4}$ of their cost. What did he lose?
7. What will be the cost of 1 bbl. 2 gal. 2 qt. of syrup at $56\frac{1}{4}$ cents per gallon?
8. What will 7 bu. 3 pk. 4 qt. of nuts cost at \$4.80 per bushel?
9. Mr. Simpson bought a farm 198 rods long and 150 rods wide at \$64 an acre. What was the entire cost?
10. What is the cost of 50 yards 2 feet 3 inches of wire netting at \$0.25 per yard?

XI.

1. If you save 10 cents a day, how much would you lay up in a leap year?
2. At 10 cents a square foot what will it cost to tin a roof 12 feet in length whose rafters are 4 feet long?
3. At eighty cents per hundred-weight how much feed can be bought for \$12?
4. How many gallons in a box 6 feet long, 3 feet wide and 2 feet deep?
5. How many bushels of wheat in a bin 5 feet long, 4 feet wide and 3 feet deep?

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1. How many acres in a field 40 rods long and 36 rods wide?

2. At $17\frac{1}{4}$ cents a square yard for lathing and plastering what will it cost to lath and plaster both sides of a partition wall, 15 feet high and 54 feet long?

3. What will be the cost of a range of 4-foot wood, 8 rods long and 6 feet high at \$4.00 a cord?

4. A man has a farm in the shape of a rectangle, $201\frac{3}{4}$ rods long and $41\frac{1}{4}$ rods wide. How many acres does it contain?

5. At 25 cents per cubic yard how much will it cost to excavate a cellar 32 feet long, 24 feet wide and 6 feet deep?

6. At \$4.50 per square what will it cost to cover a roof 32 feet in length, whose rafters are 20 feet 6 inches long?

7. The cistern at my farm-house measures eight feet square at the top and bottom and 9 feet deep. When full how many gallons of water does it contain?

8. How many gallons of water will a tank hold that is 4 feet long by $3\frac{3}{4}$ feet wide, and 5 feet 4 inches deep? Practical method.

9. Each of the two sides of a gable-roofed house is 42 feet long and $20\frac{1}{2}$ feet wide. What will the roofing cost at \$4.62 $\frac{1}{2}$ a square?

10. How many bushels of buckwheat can be put into a bin 8.5 feet long, 4.25 feet wide and 3.75 feet deep, exact measurement?

XII.

1. What cost 3.5 bushels of potatoes at \$.60 per bushel?

2. At ten cents a quart how much will a fruiterer get for 2.5 bushels of cherries?

3. A milkman buys milk at 15 cents a gallon and sells it at 7 cents a quart. How much does he make on a 10-gallon can?

4. How much do eleven barrels of flour weigh?

5. A ten-acre lot is 20 rods wide. How long is it?

1. At \$3.50 a cord what is the value of a range of wood 4 feet wide, 64 feet long and 7 feet high?

2. At $37\frac{1}{2}$ cents per cubic yard what will it cost to dig a cellar 36 feet long, 24 feet wide and $5\frac{1}{2}$ feet deep?

3. What is the cost of a block of marble $9\frac{1}{2}$ feet long, $4\frac{1}{2}$ feet wide and 3 feet 6 inches thick at \$4.00 a cubic foot?

4. What will be the cost of lathing and plastering a room 36 feet long, 27 feet wide and 14 feet high at 28 cents a square yard, no allowance for apertures?

5. At \$9.50 per thousand what would be the cost of paving a court 100 feet by 80 feet, each brick being 8 inches long and 4 inches wide?

6. How many planks 15 feet long, 15 inches wide and 2 inches thick, will floor a carriage-house, 40 feet long and 30 feet wide?

7. How many square feet in the surface of a smoke-pipe 30 feet long and 18 inches in diameter?

8. What will be the cost of covering a hall 52 feet by 32 feet, with oil-cloth at \$1.25 per square yard?

9. The rafters of a house are 20 feet long, the width of the gables at the base is 30 feet, the perpendicular height of each gable is 15 feet. What is the cost of boarding both gables at \$18 per 1000 feet?

10. My garden is 160 feet long and 120 feet wide. I have a walk 4 feet wide around it and one through the centre lengthwise, of the same width. How many square feet of the garden are taken up by the walk?

XIII.

1. What cost 3 pounds 12 ounces of butter at \$.32 a pound?

2. How many feet in 3 rods 2.5 feet?

3. How many yards of carpeting 1 yard wide, will be required to carpet a room 15 feet wide and 24 feet long?

4. At \$5 a cord what is the value of a range of 4-foot wood, 64 feet long and 4 feet high?

5. What will it cost to pave a court 40 feet long and 30 feet wide at \$2.50 per square foot?

1. How many United States legal dollars can be coined from $2186\frac{1}{4}$ ounces of silver, allowing $412\frac{1}{2}$ grains to the dollar?

2. A farmer sold a load of hay weighing 1 T. 15 cwt. at \$14 per ton. How much did he receive for the load?

3. A stationer bought 25 dozen slates at $37\frac{1}{2}$ cents per dozen and retailed them at 5 cents apiece. How much did he make on the lot?

4. What will it cost to pave a street 3 miles 115 rods long and 2 rods wide at \$46.50 per square rod?

5. What is the worth of a pile of 4-foot wood 36 feet long, $10\frac{1}{2}$ feet high at \$3.50 per cord?

6. If $\frac{1}{4}$ hundred-weight of beef cost \$2.50, how much will 872 pounds cost?

7. I wish to tile a hall, 63 feet long and 12 feet wide. If 1 tile covers 9 square inches and is worth 20 cents, what will be the cost of the tile ?

8. How many rolls of wall paper, 8 yards long and $2\frac{1}{4}$ feet wide, will be required to cover the walls of a room 27 feet long, 18 feet wide and 12 feet high ? No waste in matching.

9. What will be the cost of grading .875 of a mile and 16 rods of road at \$500 per mile?

10. What will be the cost of painting the two gables of a house, 32 feet wide at 12 cents per square yard, the ridge being $12\frac{1}{2}$ feet higher than the base of the gables?

XIV.

1. If one-fourth of a hundred-weight of beef cost \$1.50, how much will 800 pounds cost ?

2. At 25 cents a cubic yard, what will it cost to dig a cistern 6 feet deep, 8 feet long and 4 feet wide ?

3. How many cubic feet in a rectangular piece of marble 6 feet long, 4 feet wide and 3 feet high ?

4. At \$4.50 a ton how much coal will \$.50 buy ?

5. Three-fourths of a peck of oats is what part of a bushel ?

1. What will it cost to fence and break a quarter-section of prairie-land at sixty cents a rod for fencing, and \$2 $\frac{1}{2}$ an acre for breaking ?

2. Draw a diagram for a half-section of land, and find its cost at \$8.50 an acre, and 75 cents per rod for fencing it?

3. A bin is 8 feet by 20 feet. How deep will the buckwheat be in it, when it contains 800 bushels?

4. A road 72 feet wide, and $\frac{1}{2}$ -mile long, contains how much land?

5. What will it cost to build the road fence of a north-east quarter-section of land at 45 cents a rod?

6. If a well-sinker receive 75 cents per foot for the first 12 feet, \$1.00 per foot for the next 20 feet and \$1.50 for each additional foot, what will be the cost of digging a well 60 feet deep?

7. What will it cost to flag a sidewalk, 2000 feet long, with 6-foot flag-stone at 18 cents per square foot?

8. A grocer bought 18 barrels of pork at \$14 per barrel and paid in groceries \$148 $\frac{1}{2}$, the balance in cash. How much less was paid in cash than merchandise?

9. What will it cost to carpet a floor 18 feet by 24 feet, with carpet $\frac{3}{4}$ of a yard wide at \$1.25 per yard, the breadths to run lengthwise of the room, no waste in matching figures?

10. The triangular gables of a building have each a base of 40 feet, and an altitude of 15 feet. How many feet of siding will be required to cover both gables, allowing a waste of $\frac{1}{2}$ for lapping?

XV.

1. If one-half yard of calico cost 3 and one-half cents, what will 15 yards cost?

2. A boy bought half a bushel of chestnuts for \$1.25, and sold them at 10 cents a quart. How much did he make?

3. If 12 bushels of potatoes cost \$6.48, what will 2 pecks cost?

4. How many bricks (ordinary size) in a pile 10 feet long, 5 feet wide and 2 feet high?

5. How many board feet in 2 planks 10 feet long, 8 inches wide and 3 inches thick?

1. A farmer bought $13\frac{1}{4}$ acres of land at \$32 an acre, and paid for it with wheat at \$1.11 a bushel. How many bushels did it require?

2. A drover made \$326 by selling sheep at \$5.00 per head that cost him \$4.50 each. How many did he sell?

3. The capacity of my cistern is 215 cu. feet, 945 cu. inches. How many barrels of water will it hold?

4. How many gallons of water will a tank hold that is 8 feet long, $4\frac{1}{8}$ feet wide and 3 feet high; exact measurement?

5. How many bottles, each holding $1\frac{1}{2}$ pints, will be required for bottling 2 barrels of vinegar?

6. The reception-room at Riverside is 12 feet long, $11\frac{1}{2}$ feet wide and $7\frac{1}{2}$ feet high. What will it cost to lath and plaster it at $24\frac{1}{4}$ cents per square yard, no allowance for doors and windows?

7. The largest of the Egyptian pyramids is square at its base, and measures 693 feet on each side. How many acres does it cover?

8. A dealer sold 9 tons 12 hundred-weight of hay at \$17.50 a ton and made \$14.00. What did he pay for it?

9. How many cords in a pile of 4-foot wood, $12.87\frac{1}{2}$ feet long and $6\frac{3}{4}$ feet high?

10. A farmer purchased $8\frac{3}{4}$ acres of land at \$42 $\frac{3}{4}$ an acre, and paid for it in butter at 20 cents a pound. How many pounds were required?

XVI.

1. *How many feet high is a horse that is 15 hands high?*

2. *A boy spent three-fifths of his money and had \$3.60 left. How much did he spend?*

3. How many tiles 3 inches square, will be required to cover a hall 30 feet long, and 9 feet wide?

4. How many yards of oilcloth a yard wide, will be required to cover a floor 18 feet by 25 feet?

5. A grocer has 4 pounds 8 ounces of tea that cost him \$2.70. How must he sell it per pound to gain \$1.80?

1. At $62\frac{1}{2}$ cents a rod, what will it cost to fence a field of 24 acres, if it is 60 rods wide?

2. How many cubic yards or loads will be required to remove the earth from a cellar, 32 feet long, 25 feet wide and $5\frac{3}{4}$ feet deep?

3. I have $5\frac{1}{2}$ acres of woodland, and sell $38\frac{1}{2}$ square rods. How much have I left?

4. My wood-house measures on the inside 24 feet in length, 16 feet in width, and is 8 feet high. How many cords of 4-foot wood will it hold?

5. A tank which is 6 feet long and 4 feet wide, has 3 feet of water in it. How many gallons is that?

6. A rectangular corner field of a farm is 80 rods long and contains 20 acres. What will the road fence around the two sides cost at 90 cents a rod?

7. A farmer paid \$1.15 per hundred-weight for feed. What was the cost of $7\frac{1}{4}$ tons?

8. How many bushels of rye may be put into a cubical bin, which is 9 feet square and $4\frac{1}{2}$ feet deep?

9. How much meadow-hay is there in a mow 42 feet long, 20 feet wide, and 22 feet deep, allowing 400 cubic feet to the ton?

10. What will be the cost of building a fence around a park one-half mile in circumference? The posts are 8 feet apart and cost 15 cents each; 2 inch pickets are used, placed 2 inches apart, and cost \$3.50 per hundred. Other material and labor cost \$225.

XVII.

1. If 1.5 bushels of walnuts cost \$1.50, what will 7.5 bushels cost?

2. What is the price of 1 bushel of beans if 1 peck and 3 quarts cost \$1.10?

3. How many board-feet in a stick of timber 40 feet long, and 10 inches by 12 inches at each end?

4. If hay is \$16 a ton, what are 750 pounds worth?

5. How many rods of fence are required to fence both sides of a road 2 miles long?

1. My garden is 160 feet long, and 88 feet wide. How many square feet does the walk contain which is 4 feet wide, and runs around the inside of the whole garden?

2. Mr. Webster sold a portion of his farm, which is in the shape of a triangle, the two shortest sides being respectively 40 rods and 30 rods. How many acres in the piece?

3. At \$1.25 a rod, what will it cost to fence a rectangular piece of ground, 63.5 rods long and 35.75 rods wide?

4. If $\frac{4}{5}$ of a ton of hay will pay for 4 barrels of apples, worth \$2 $\frac{1}{4}$ a barrel, what does the hay cost per ton?

5. A range of bricks is 28 feet long, 8 feet wide, and 12 feet high. How many bricks are there in the range?

6. How many bushels of corn will a bin contain that is 8.5 feet long, 4.25 feet wide, and 7 $\frac{1}{2}$ feet deep?

7. A grocer bought 15 hundred-weight, 22 pounds of sugar, at \$7.50 a hundred-weight; and 736 pounds of pork at \$8.50 a hundred-weight. How much does he gain by selling the whole at 9 cents a pound?

8. In a township 6 miles square, according to U. S. Government Survey, how many farms are there of 320 acres each?

9. If a cubic foot of water weighs $62\frac{1}{2}$ pounds, how many tons are there in a reservoir which covers 5 acres of land, the water being $8\frac{1}{2}$ feet deep?

10. I have a circular fish-pond, which is just 500 feet across it. How many acres does it contain?

XVIII.

1. *How many acres of land in one-fourth section?*

2. *Three bushels of oats will sow an acre. What will it cost to sow 8 acres, if the seed cost \$.50 a bushel?*

3. *What cost 5 pounds 12 ounces of butter, when three-fourths of a pound costs 18 cents?*

4. *How many square rods in three-eighths of an acre?*

5. *If a man walk .25 of a mile in 5 minutes, how many hours at that rate will it take him to walk 6 miles?*

1. How many cords of tan-bark in a load 16 feet long, 4 feet wide, and 6 feet high?

2. What is the value of $3\frac{3}{4}$ tons of hay at 75 cents a hundred-weight?

3. From a cask of vinegar containing 43 gallons, 3 quarts, a grocer sold at one time 19 gallons $2\frac{3}{4}$ quarts. What decimal part of the whole remained?

4. What will it cost to pave a rectangular court, $22\frac{1}{2}$ yards long, and 14 yards wide at \$3.20 per square yard?

5. I sold Wm. Jackson a triangular piece of land, the base of which was 120 rods and the altitude 17 rods. How much did I receive for it at \$40 an acre?

6. How many tons of ice can be put into my ice-house, which is 30 feet long, 24 feet wide and 16 feet high, providing one cubic foot of ice weighs $56\frac{1}{2}$ pounds?

7. What will it cost to bronze a cube, each face of which is $2\frac{1}{2}$ feet square at $2\frac{1}{2}$ cents an inch?

8. Find the cost of building a fence around each section in a township of land at 40 cents a rod?

9. At \$72 an acre, a farm is worth \$12,240. It is in the form of a rectangle 160 rods wide. What will it cost to put a fence around it at 75 cents a rod?

10. What will it cost to paper the walls and ceiling of a room 36 feet long, 24 feet wide, 18 feet high with paper $1\frac{1}{2}$ feet wide, at \$1.50 a roll, allowing 64 square yards for doors and windows, each roll being 8 yards long?

XIX.

1. What cost 7 lb. 8 oz. of beefsteak at 22 cents a pound?

2. How much was the gain on 20 bushels of cranberries bought at \$4 a bushel, and sold at 15 cents a quart?

3. If 1 quart of nuts cost 11 cents, how many bushels can be bought for \$35.20?

4. How long must a lot be to contain .5 of an acre, if it is 4 rods wide?

5. How many yards of oilcloth, 4 feet wide, will be required to cover a room 12 feet by 16 feet?

1. What would farmer Hunt receive for 22 tons 250 pounds of hay at \$12.50 a ton?

2. If a junk-man pays 2 cents a pound for old iron, how much will I receive for 1 ton 17. cwt. 3 qr. 7 lb?

3. On Christmas, 1891, Raymond was 8 years 5 months and 11 days old. When was he born?

4. Find the time from Dec. 17, 1884, to March 3, 1892?

5. Wm. P. Maxwell was born May 24, 1842. How old was he Jan. 9, 1892?

6. If $4\frac{1}{2}$ bushels of wheat cost \$5.94, how many can be bought for \$1080?

7. A farmer sold 70 bushels of wheat at $\$1\frac{1}{8}$ a bushel and received \$47 cash the balance in muslin at $\$1\frac{3}{8}$ a yard. How much muslin did he receive?

8. A note dated Dec. 30, 1882, was paid Nov. 3, 1885. How long had it run?

9. From a bar of silver weighing 25 pounds were coined 200 dollars. How much of the bar remained uncoined?

10. A man owning a section of land gave each of his 6 sons a farm containing 40 acres and 95 square rods. How much had he left?

XX.

1. A farmer killed 6 lambs, and the total weight was 289 lb. 14 oz. What was the average weight?

2. At \$1.20 a bushel for plums, what part of a bushel can be bought for \$.75?

3. How many square yards in the ceiling of a room, the floor of which is 20 feet wide, and 27 feet long?

4. The ceiling of the above room is 12 feet high. How many square yards in the sides?

5. How many gallons of water will a tank 5 feet long, 3 feet wide, and 4 feet deep hold?

1. Reduce $\frac{1}{4}$ quart to the fraction of a pint, to the decimal of a gallon and to the fraction of a barrel.

2. What weight of water will a cistern contain, which is 3 feet by 4 feet across, and 10 feet deep, a cubic foot of water weighing $62\frac{1}{2}$ pounds?

3. Reduce 44 rd. 2 yd. 1 ft. 11.04 in. to the decimal of a mile?

4. A farmer wishes to lay off a rectangular lot, containing 2 acres, with a frontage of 16 rods on the river-road. How deep must he make the lot?

5. From $3\frac{1}{2}$ pecks of seed were raised $3\frac{1}{2}$ bushels. What decimal part of the crop was the seed?

6. A gallon of paint, worth \$1.60, covers 180 square feet. What will be the cost of paint sufficient to cover both sides of a tight board fence 4 feet high, which encloses a lot 8 rods by 20 rods?

7. Find the sum of $\frac{3}{4}$ of a mile; .05 of a mile; and $\frac{1}{4}$ of a rod?

8. From a lot 80 rods square, I sold 80 square rods at \$200 an acre, and the balance at \$150 an acre. How much did I get for both sales?

9. What will it cost to slate the two sides of a roof 44 feet by 18 feet at \$5.50 per square?

10. A contractor agrees to dig a ditch $\frac{1}{2}$ mile long, 6 feet wide at the top, 8 feet wide at the bottom and 5 feet deep, for 25 cents a cubic yard. How much money should he receive for the work?

PERCENTAGE ADVANCED.

Express $\frac{2}{3}$ decimally, or as a rate per cent.

$\frac{2}{3} = .28\bar{3} = 28\frac{1}{3}\%$. Since we are to obtain the number of hundredths, or the rate per cent. to which $\frac{2}{3}$ is equal, we divide the numerator by the denominator, carrying the division to two decimal places and the remainder as a fraction.

Express the following decimally or as a rate per cent.

1. $\frac{1}{2}\%$, 5% , $12\frac{1}{2}\%$, 20% , 25% , $62\frac{1}{2}\%$, $37\frac{1}{2}\%$.
2. $87\frac{1}{2}\%$, $33\frac{1}{3}\%$, $6\frac{1}{4}\%$, 225% , $\frac{1}{2}\%$, $\frac{3}{8}\%$, $\frac{3}{4}\%$.
3. $\frac{3}{10}\%$, $\frac{2}{3}\%$, $1\frac{1}{8}\%$, 50% , $.05\%$, $\frac{2}{3}\%$, $\frac{1}{8}\%$, $\frac{4}{5}\%$.
4. $\frac{1}{8}\%$, $\frac{1}{5}\%$, $16\frac{2}{3}\%$, 200% , $14\frac{2}{3}\%$, $\frac{2}{30}\%$, $\frac{4}{5}\%$, $\frac{1}{10}\%$.
5. $\frac{4}{5}\%$, $3\frac{4}{10}\%$, $8\frac{2}{3}\%$, $50\frac{3}{4}\%$, $15\frac{2}{3}\%$, $\frac{1}{100}\%$, $\frac{3}{4}\%$, $100\frac{4}{5}\%$.

ILLUSTRATIVE EXAMPLE.

Express $37\frac{1}{2}\%$ as a common fraction.

$37\frac{1}{2} = \frac{37\frac{1}{2}}{100} = \frac{75}{200}$ or $\frac{3}{8}$. Since any per cent. equals the same number of hundredths, $37\frac{1}{2}\% = \frac{37\frac{1}{2}}{100}$, or $\frac{3}{8}$.

Express as a common fraction, smallest terms.

6. 2% , 60% , 50% , 25% , 75% , 70% , 65% .
7. $12\frac{1}{2}\%$, $16\frac{2}{3}\%$, $33\frac{1}{3}\%$, $37\frac{1}{2}\%$, $14\frac{2}{3}\%$, $6\frac{1}{4}\%$.
8. 14% , 30% , $\frac{2}{3}\%$, $\frac{1}{2}\%$, $\frac{1}{4}\%$, $\frac{1}{8}\%$, $\frac{1}{5}\%$.
9. One-fourth of anything is how many hundredths of it?
10. In a hatch of 100 eggs, $\frac{2}{3}$ were white leghorns. How many hundredths were leghorns?

ILLUSTRATIVE EXAMPLES.

What is 10% of 150 tons?

ANALYSIS:—10% means $\frac{10}{100}$ or $\frac{1}{10}$; and $\frac{1}{10}$ of 150 tons is 15 tons.

What is 8% of \$408?

ANALYSIS:—Since 8% is $\frac{8}{100}$ or .08, the required percentage is .08 of \$408.

OPERATION.

\$ 408

.08

\$32.64

I.

1. What part of \$50 is \$5? What per cent.?
2. A clerk who received \$600 had his salary raised 25 per cent. What does he receive now?
3. A merchant marks an article \$2.80, but takes off 14 and two-sevenths per cent. for cash. What is the selling price?
4. If to 8 gallons of alcohol 2 gallons of water are added, what per cent. of the mixture is alcohol?
5. If to 48 gallons of milk 2 gallons of water are added, what per cent. of the mixture is water?

What is the percentage of the following?

- | | |
|----------------------|-------------------------------------|
| 1. 20% of 120 men? | 6. $6\frac{1}{4}\%$ of \$320? |
| 2. 3% of 60 bushels? | 7. 45% of 218 tons? |
| 3. 10% of 90 yards? | 8. $33\frac{1}{3}\%$ of \$480? |
| 4. 5% of 600 miles? | 9. $4\frac{1}{2}\%$ of 312 rods? |
| 5. 25% of 240 sheep? | 10. $6\frac{1}{4}\%$ of 160 pounds? |

II.

1. A man bought a cow for \$20. For what must he sell her to gain 5 per cent?

2. What is one-fourth per cent. of \$120?

3. Cloth bought for \$2 a yard was sold at an advance of 25 per cent. What was the price received for ten yards?

4. An auctioneer sold a horse for \$160 and charged 5 per cent. for his services. How much did he receive?

5. A grocer bought flour for \$5.88 a barrel and sold it at a gain of 16 and two-thirds per cent. What was his retail price per barrel?

Find the percentage of the following:

1. 35% of 600 horses?

2. 7% of 130.5 miles?

3. 50% of 200 apples?

4. $16\frac{2}{3}\%$ of 48 pecks?

5. $12\frac{1}{2}\%$ of 64.8?

6. $8\frac{1}{3}\%$ of 2400 cows?

7. $33\frac{1}{3}\%$ of 6 gallons?

8. $6\frac{1}{4}\%$ of an acre?

9. $66\frac{2}{3}\%$ of 60 hogsheads?

10. $37\frac{1}{2}\%$ of \$600?

III.

1. How many dollars are made by selling a watch which cost \$18, at an advance of 20 per cent.?

2. A boy deposited \$40 in a savings-bank, and afterward drew out 62.5 per cent. of it. How much had he left in the bank?

3. What is 4 per cent. and .4 per cent. of \$500?

4. A saddle which cost \$14 was sold at a loss of 70 per cent. What was the selling price?

5. A commission merchant sold 120 barrels of apples for \$2 each, and charged 50 per cent. for his services in selling. How much did he receive?

Find the percentage of the following:

- | | |
|----------------------------------|---|
| 1. $16\frac{3}{4}\%$ of a day? | 6. $9\frac{1}{4}\%$ of \$400? |
| 2. $12\frac{1}{2}\%$ of a gross? | 7. $37\frac{1}{2}\%$ of \$8.24? |
| 3. 75% of a ton? | 8. $\frac{3}{8}\%$ of 824 feet? |
| 4. $\frac{3}{4}\%$ of a ton? | 9. $33\frac{1}{3}\%$ of a yard? |
| 5. $\frac{3}{8}\%$ of a ton? | 10. $66\frac{2}{3}\%$ of a square foot? |

IV.

1. A farmer sold a horse that cost him \$200 at a loss of 25 per cent. How much did he receive for him?

2. A dishonest dealer sold coal 20 per cent. short on every ton. The customer who purchased ten tons was defrauded out of how much coal?

3. A farmer had 192 barrels of potatoes, and sold 12 and one-half per cent. of them. How many barrels did he sell?

4. Goods costing \$800 were sold for three-fourths of their cost. How much was lost?

5. A farmer had 400 sheep, but lost one-half per cent. of them by carelessness. How many sheep had he left?

Find the percentage of the following:

- | | |
|----------------------------------|---|
| 1. 7% of \$428? | 6. $87\frac{1}{2}\%$ of a mile in feet? |
| 2. $5\frac{1}{2}\%$ of 1000 men? | 7. $87\frac{1}{2}\%$ of a ton? |
| 3. 1% of 4500 horses? | 8. 25% of a lb. of cheese? |
| 4. 20% of 60 cents? | 9. 1% of 10? |
| 5. $62\frac{1}{2}\%$ of \$100? | 10. 105% of \$600? |

V.

1. What is 10 per cent. of a ton of coal worth at \$5 a ton?

2. What is the value of 25 per cent. of a barrel of flour at 3 cents per pound?

3. My garden is 165 feet long and 66 and two-thirds feet wide. What per cent. of an acre is it?

4. If 3 bushels of wheat cost \$3.60, how much will 75 per cent. of a bushel cost?

5. What is gained by selling a farm which cost \$3200, at a profit of 25 per cent?

Find the percentage of the following:

- | | |
|--|--------------------------------------|
| 1. $\frac{1}{2}\%$ of \$600? | 6. $6\frac{1}{2}\%$ of 4 bu. 4 qts.? |
| 2. 25% of $\frac{3}{4}$ of a ton? | 7. $\frac{3}{4}\%$ of \$1050? |
| 3. $6\frac{3}{4}\%$ of 3 gallons? | 8. $12\frac{1}{2}\%$ of 8.4 gallons? |
| 4. 8% of $\frac{1}{4}$ of a dollar? | 9. 7% of 18 bu. of corn? |
| 5. $\frac{7}{8}\%$ of 4 lb. of butter? | 10. 6% of $\frac{1}{16}$? |

VI.

1. What fraction of \$88 is \$11? What per cent.?

2. A boy has \$150 and deposits 75 per cent. of it in a savings bank. How much did he deposit?

3. What is 16 and two-thirds per cent. of 240 sheep?

4. How much corn at three-fifths dollar a bushel can be had for \$1.20?

5. At one-sixteenth dollar a pound, how many pounds of rice can be bought for \$3.25?

1. From a cask of molasses containing 42 gallons, $33\frac{1}{3}\%$ of it was drawn. How many gallons remained?

2. A carpenter who received \$30 per week, had his wages raised 10%. What are his daily wages now?

3. I purchased a bill of books which amounted to \$363.50. From this I received a deduction of $12\frac{1}{2}\%$. How much cash did I pay for the books?

4. A coal merchant bought 96 tons of coal at \$4.62 $\frac{1}{2}$ a ton, and sold it at a gain of 24%. How much money did he make on this purchase?

5. A man having \$3200 paid out 6 $\frac{1}{4}\%$ of it for a building lot, and invested the balance in a house. What was the cost of his house?

6. How much money is made by selling flour at 25% above cost, the cost being \$5 per barrel?

7. How much money is lost on goods which cost \$24, by selling at a loss of $12\frac{1}{2}\%$?

8. At what price must hats which cost 80 cents each, be sold that no more than $12\frac{1}{2}\%$ should be lost?

9. At what price per quire must paper be sold, which cost \$2 a ream, to gain 20%?

10. How much money will a farmer make on a horse which cost him \$120, if he gains $33\frac{1}{3}\%$ when he sells him?

VII.

1. A farmer having 25 barrels of apples sold 60 per cent. of them at \$2 a barrel. How much did he receive?

2. A grocer retailed pork that cost \$15 a barrel at an advance of 20 per cent. How much was that a pound?

3. A farmer having 5 and three-eighths tons of hay, sold all but 3 and one-fourth tons. How much did he sell?

4. What will 5 pounds 9 ounces of beef cost at 16 cents a pound?

5. A pound of cheese cost one-eighth of a dollar, and 2 pounds of butter cost \$.75. What will be the cost of a pound of both?

1. Of the 1240 bushels of grain raised by a farmer, 42% of it was wheat, 24% oats, and the balance corn. How many bushels of corn did he raise?

2. A grocer bought 1750 oranges and found 18% of them spoiled. How many oranges were salable?

3. For what must butter, which cost 30 cents a pound, be sold to gain 20%?

4. Mary studies at home daily 15% of the 24 hours. How many hours and minutes does she study each day?

5. Find $8\frac{3}{4}\%$ of 10 pounds 11 ounces of butter?

6. What per cent. do I lose when I sell goods at $\frac{4}{5}$ of their cost?

7. A merchant sold 40 yards of silk, costing \$4.37 $\frac{1}{2}$ per yard, at an advance of 20%. What amount of money was made?

8. A speculator bought a house and lot for \$5740, and sold it at a gain of 14 $\frac{3}{4}\%$. How much did he gain?

9. A kindling-wood merchant bought 128 cords of wood at \$5.12 $\frac{1}{2}$ a cord, and sold it at a gain of 44%. What was his entire profit?

10. A grocer bought a hogshead of sugar, containing 9 cwt. 56 lb. for \$86.04, and paid \$9.56 for freight. At what price per pound must he sell it to gain 20% on the entire cost?

VIII.

1. If apples cost \$.80 a bushel and are sold at a gain of 25 per cent., what will be the selling price of 100 bushels?

2. What must be paid for 20.75 yards of carpet at \$4 a yard?

3. For what must 6.5 yards of cloth, which cost \$2.50 per yard, be sold that there may be a gain of 20 per cent.?

4. How many cords were left in a range of wood 128 feet long, 6 feet high and 4 feet wide, after taking away 50 per cent.?

5. How many surface feet in a block of marble 4 feet long and 3 feet square at each end?

1. A farmer sold a horse for which he paid \$187.50 at a loss of 18 $\frac{1}{2}$ %. What was his loss on the sale of the horse?

2. A man sold 6 $\frac{1}{4}$ % of a farm of 240 acres. How many acres did he have left?

3. The valuation of a city lot 25 feet wide is \$2.40 per front-foot. What would be the tax on it at an assessment of 1 $\frac{3}{4}$ %?

4. A boy in the grammar class of our school spends 20% of the day in "home study." How long does he study daily at home?

5. A merchant having 450 barrels of flour sold 24% of it for \$583.20. How much was that per barrel?

6. Mr. R. C. Love bought a Parker and Stone harvester for \$200 and sold it so as to make 20%. What was his selling price?

7. A merchant buys cloth at \$.50 per yard and sells it at an advance of 25%. What does he ask per yard?

8. A farmer hires a piece of ground for \$360 upon which he raises 1500 barrels of potatoes. He spends \$265 for help, and \$625 for other expenses. How much must he get per barrel for the potatoes to make 20% on the money expended?

9. A wholesale grocer bought 50 bags of coffee, each bag containing $49\frac{1}{2}$ pounds at 18 cents a pound, and sold it at a profit of 25%. How much did he make?

10. A grocer bought a barrel of maple syrup containing 50 gallons at 90 cents a gallon; 10 gallons leaked out. At what price per gallon must he sell the remainder that he may clear 16 $\frac{2}{3}$ % on the cost of the whole?

IX.

1. *How many hours in 25 per cent. of a day?*

2. *A man having \$40 gave 20 per cent. of it to each of his 4 sons. How much had he left?*

3. *At 6 cents a pint how much molasses can be bought for \$4.20?*

4. *In 5 gross of pens how many scores?*

5. *I have an open water tank 4 feet square; how many square feet of copper will be required to line it?*

1. A provision dealer buys 80 barrels of pork for \$1200, and sells it at a gain of 25%. What did he receive per pound for it?

2. I send my agent \$800 with directions to take out 6 $\frac{1}{4}$ % for his expenses, and with the balance to purchase apples for me at \$2 a barrel. How many barrels will I receive?

3. A farmer having 42 cows, lost $19\frac{1}{11}\%$ of them by disease. How many has he left?

4. What is $14\frac{7}{8}$ per cent. of 5 pounds 4 ounces of cheese?

5. What is $33\frac{1}{3}$ per cent. of 40.5 feet, and $\frac{1}{4}$ per cent. of 2 miles?

6. A carriage bought for \$180, was sold at a loss of $12\frac{1}{2}\%$. Find the selling price.

7. A coal merchant gains $37\frac{1}{2}\%$ on coal, which cost \$7.20 per ton. What would be his profit on 185 tons?

8. I bought 15 cases of shoes at \$75 each, and sold them at an advance of $18\frac{3}{4}\%$ on the purchase price. What was the entire gain?

9. A man bought 20 dozen brooms at 25 cents apiece, and sold them by the dozen at an advance of 20%. How much did he get per dozen?

10. A grocer bought 24 packages of butter, averaging 50 pounds each at 24 cents per pound, and sold it at an advance of $16\frac{2}{3}\%$. What did he receive for $87\frac{1}{2}\%$ of it?

X.

1. A wagon which cost \$49 was sold at a loss of 14 and two-sevenths per cent. What was the selling price?

2. How many square feet in a piece of oilcloth 30 inches wide, and 40 feet long?

3. What per cent. of the day has passed at 6 P. M.?

4. From an acre of land I sold 16 square rods, and also 8 rods square. What per cent. have I left?

5. If sugar cost 4 cents a pound, what will 8 lb. 12 oz. bring, when sold at an advance of 14 and two-sevenths %?

1. A grocer bought dried fruit at 25 cents a pound, and lost by the purchase 20%. What was his selling price per pound?

2. A merchant tailor bought 40 yards of cloth for \$180, and sold it at an advance of $16\frac{2}{3}\%$. How much did he receive per yard for the cloth?

3. If from a barrel containing 53 gallons 2 quarts of kerosene, 20% leaks out, for how much per gallon must the balance be sold to realize \$4.28?

4. A vender sold 40 bushels 1 peck of potatoes for \$32.20. How much per bushel should he have sold them to have yielded him an additional profit of 25%?

5. A miller manufactured 5280 barrels of flour. He sold at one time $12\frac{1}{2}\%$, at another time $33\frac{1}{3}\%$ of the remainder, and $\frac{1}{2}$ of what remained after the second sale at another time. The balance he sold for \$4666.20. How much did he receive per barrel for the last lot?

6. A merchant bought 64 barrels of flour for \$352, and sold it at a gain of $37\frac{1}{2}\%$. What price did he receive per barrel for it?

7. Mr. Brown pays \$7650 for a stock of spring goods, and marks them to sell at an advance of $37\frac{1}{2}\%$. What will be his profits, after deducting his expenses of \$1480?

8. I purchased two lots of land for \$250 each, and sold one for $37\frac{1}{2}\%$ more than it cost, and the other for $\frac{1}{4}$ less than the cost. What was my gain on the lots?

9. A builder paid \$845 for labor and material in the erection of a house, which he sold at an advance of $16\frac{2}{3}\%$ on the cost. What was his selling price?

10. A coal merchant bought a cargo of coal weighing 340 tons, 2240 pounds each, for \$4.25 per ton. He sold it at a gain of 20% on each ton. How much money did he make on the whole cargo, selling by the short ton,—2000 pounds?

SECOND GENERAL PROBLEM.

ILLUSTRATIVE EXAMPLES.

1. What per cent. of 75 is 15 ?

ANALYSIS:—

15 is $\frac{1}{5}$ or $\frac{1}{5}$ of 75.

$\frac{1}{5}$ expressed in hundredths or decimally equals .20 or 20%.

or

Since 1% of 75 is .75, 15 is as many per cent. of 75 as .75 is contained times in 15 or 20%.

2. What % of 375 yards is 150 yards?

ANALYSIS:—

150 yards is $\frac{2}{5}$ or $\frac{2}{5}$ of 375 yards

$\frac{2}{5}$ expressed decimally equals .40 or 40%.

or

Since 150 yards, "the percentage," is $\frac{2}{5}$ of 375 yards the per cent. is $\frac{2}{5}$ of 100% or 40%.

OPERATION:—

150 yards ÷ 375 yards = .40 or 40%.

I.

1. A merchant buys calico for 5 cents a yard, and sells for 8 cents a yard. What per cent. does he make?

2. A grocer buys pork at \$16 a barrel, and retails it at 10 cents a pound. What is his gain per cent.?

3. A hardware merchant sells a stove that costs \$18 at \$6 above cost. What per cent. did he make?

4. Flour that cost \$5 a barrel was sold for \$4.50 a barrel. What was the loss per cent.?

5. A grocer sells maple sugar at 15 cents a pound, that cost him 12.5 cents. What per cent. does he make?

What per cent. of

1. 240 is 80?

2. \$5 is \$2.50?

3. \$9.00 is 45 cents?

4. 144 rods is 36 rods?

5. 560 pounds is 80 lbs.?

6. 8 bushels is 4 qts.?

7. \$4 is 3 dimes?

8. 3 gross is 9 dozens?

9. 2 tons is 1500 pounds?

10. 2 bbl. of flour is 98 lbs.

II.

1. A dealer bought a case of one dozen hats for \$24, and sold them at \$2.75 apiece. What per cent. did he make?

2. If you buy tea at 50 cents a pound, and sell it at 75 cents a pound, what per cent. is your profit?

3. A boy bought a pair of skates for \$1.20 and sold them for \$.80. What per cent. did he lose on them?

4. What per cent. is lost on goods costing \$16 and selling for \$14?

5. A fruiterer bought pineapples at \$8 a hundred, and sold them at 12 cents apiece. What per cent. did he make?

What per cent. of:

1. 128 is 16?

2. \$64 is 40 cents?

3. $62\frac{1}{2}$ bushels is 16 bushels?

4. $15\frac{3}{4}$ pounds sugar is 9 pounds?

5. \$480 is \$26.40?

6. 46 gallons is 5 gal. 3 qt.?

7. \$1.00 is $16\frac{2}{3}$ cents?

8. $1\frac{1}{2}$ miles is $\frac{5}{8}$ miles?

9. $4\frac{1}{2}$ rods is $3\frac{3}{4}$ rods?

10. 11 rods $6\frac{1}{2}$ ft. is 4 rd. 2 yd.?

III.

1. *Butter which cost 30 cents a pound, was sold at a gain of 6 cents a pound. What was the gain per cent.?*
 2. *One dime is what per cent. of 4 cents?*
 3. *One-half of a New York State shilling is what per cent. of \$1.00?*
 4. *Sold a watch-chain for \$24 and gained \$4. What per cent. was made?*
 5. *A grocer pays \$5.125 per barrel for flour, and sells it at \$6.75. How much was his gain on 24 barrels?*
-

1. A farmer having 370 sheep, sold 148 of them. What per cent. of his flock did he sell?
2. A farmer raised 150 bushels of corn, and sold all but 40 bushels. What per cent. of the crop did he sell?
3. What per cent. of a score is a dozen?
4. If a milkman add 1 pint of water to every gallon of milk he sells, what per cent. of water does he sell?
5. If 4 quarts of wheat are given as toll for grinding a bushel, what per cent. is the cost of grinding?
6. If calico costing 8 cents per yard is sold for 11 cents, what per cent. is gained?
7. What would be the loss per cent. on goods costing 15 cents a yard if sold at 12 cents?
8. Mr. Belton sells plows at \$10.02, that cost \$12. What is the loss per cent.?
9. I sold a piano to Wm. Burns at a profit of \$40. He paid me \$540 for it. What was my per cent. of gain?
10. Sold my watch for \$156, and thereby lost \$26. What per cent. did I lose on the purchase money?

IV.

1. A dealer buys boots at \$60 a dozen pairs, and sells them at \$6.50 a pair. What per cent. does he make?

2. If I sell tea at 30 cents a pound that cost me 45 cents, what per cent. do I lose?

3. A dealer bought coal for \$3.75 per ton, and sold it at \$4.50 a ton. What per cent. did he make?

4. 3.5 tons of coal cost \$35. How much will \$25 buy?

5. A ton of hay cost \$12, what will 8 hundred-weight cost?

1. From a barrel of flour 56 pounds had been used. What per cent. of the whole barrel remained?

2. What per cent. of any number is $\frac{3}{8}$ of it and $\frac{1}{2}$ of it?

3. A lot is 5 rods wide and 16 rods long. What per cent. of an acre is it?

4. A merchant having \$600, bought 3 cases of cashmere, each case containing 100 yards at $87\frac{1}{2}$ cents a yard. What per cent. of his money had he left after paying his bill?

5. From a field $37\frac{1}{2}$ rods long, and 40 rods wide, a lot of $7\frac{1}{2}$ rods long and 10 rods wide was sold. What per cent. of the field remained unsold?

6. A farmer buys 24 Jersey cows at \$80 each. After losing 6 by disease, sells the others at \$110 per head. How much per cent. does he gain or lose?

7. I buy apples at \$2.75 a barrel, and sell them at \$3.50. After paying $\$1\frac{1}{2}$ for freight on each barrel, what per cent. do I make on the purchase money?

8. A speculator bought 280 bales of cotton for \$11200 and sold it all for \$38 per bale. What per cent. did he lose?

9. A farmer bought 160 acres of land at \$50 per acre and paid 25% of the cost of the land for buildings. He then sold the farm for \$11250. What per cent. did he make?

10. A druggist buys opium at \$5 per pound and sells it at \$.50 per ounce. What per cent. does he make?

V.

1. My house-lot is 8 rods wide and 165 feet long. What per cent. of an acre is it?

2. How much is gained by selling baskets at 20 per cent. profit, when the cost is \$.43?

3. What will 6.25 bushels of potatoes cost at \$.25 a bushel?

4. If .25 of a pound of sugar cost one cent, how much will \$5.76 buy?

5. A boy sold a sled for \$2.40, which was three-fifths of its first cost. How much per cent. did he lose?

1. If a pupil is absent from school 6 days in a term of 75 days, what per cent. of the time is he absent?

2. Out of three casks of molasses, containing 126 gallons, 8% was lost by leakage, and 40% of the remainder was sold. What per cent. of the whole remained?

3. A Long Island farmer raised 250 bushels of potatoes and sold all but 75 bushels. What per cent. did he keep?

4. If a man earn \$90 per month and expends \$72 for necessary expenses, what per cent. of his earnings has he left?

5. What per cent. of 40 gallons is 1.6 pints?

6. A gentleman bought a house for \$1750, and sold it for \$300 more than he gave. What per cent. was his profit?

7. A huckster bought 5 bu. 1 pk. 7 qt. of chestnuts at \$2.56 a bushel, and sold the lot at retail for \$20. What was the per cent. of gain?

8. A grocer bought four barrels of vinegar containing 144 gallons at $22\frac{1}{2}$ cents a gallon. On measurement he had only 108 gallons, which he sold at \$.33 per gallon. What was his per cent. of gain on the purchase?

9. A farmer who raised 500 bushels of potatoes refused to sell at 50 cents a bushel. After losing 10% by rot, he sold the remainder at 40 cents per bushel. What per cent. did he lose?

10. A miller purchased 500 bushels of wheat at \$1.12 a bushel. He sold $\frac{2}{3}$ at a loss of $16\frac{2}{3}\%$, and the remainder at a gain of $33\frac{1}{3}\%$. What per cent. did he gain on the lot?

THIRD GENERAL PROBLEM.

ILLUSTRATIVE EXAMPLE.

1. 45 is 9% of what number?

OPERATION.

$$\begin{array}{r} .09 \overline{)45.00} \\ \underline{500.} \end{array}$$

ANALYSIS:—Since 9% or $\frac{9}{100}$ of a given number is 45, $\frac{100}{9}$ is $\frac{1}{9}$ of 45, or 5. 100 per cent. of the *required number* is 100 times 5, or 500.

I.

1. A man sold a saddle for \$12 and lost 40 per cent. What did it cost?
2. A lady sold a cart for \$24 which was 60 per cent. of its first cost. What did it cost her?
3. A boy earned \$15 which was 20 per cent. of what he had before. How much has he now?
4. A farmer sold 40 bushels of potatoes at 75 cents a bushel. If this was 25 per cent. of his crop, how many bushels had he left?
5. A tailor sold a coat at a profit of \$3 and gained 30 per cent. What did it cost him?

Of what number are

- | | |
|--|---|
| 1. 12 men 40 per cent.? | 7. 2.4 ounces are 6% of |
| 2. \$250.25 25%? | how many pounds? |
| 3. 37 lbs. 8 oz. 16 $\frac{3}{4}$ %? | 8. 9.75 dozens are $\frac{3}{4}$ % of |
| 4. 4 yd. 1 $\frac{1}{2}$ ft. 12 $\frac{1}{2}$ %? | how many? |
| 5. 16 bu. 4 qt. 10%? | 9. 9.75 scores are $\frac{3}{8}$ % of |
| 6. 3 gal. 2 qt. are 33 $\frac{1}{3}$ % of | how many? |
| what? | 10. $\frac{4}{5}$ is $\frac{3}{4}$ % of what? |

II.

1. A farmer sold a horse \$12 less than cost and thereby lost 20 per cent. What did the horse cost him?
2. A book which cost \$4.50 was sold at a gain of \$1.50. What was the gain per cent.?
3. A dealer sold a cow, which cost him \$32, at a gain of 25 per cent. What was his selling price?

4. A sleigh sold for \$24 at a loss of 20 per cent. What was its first cost?

5. By selling flour at \$5.04 a barrel, 14 and two-sevenths per cent. was lost. What was the cost per pound?

1. \$25 is $6\frac{1}{4}\%$ of my money. How much money have I?

2. 2 pounds 4 ounces was 25% of the amount of candy Mary had given to her. How much candy did she receive?

3. A farmer sold 224 bushels of rye, which was 40% of his entire crop. How much was this crop worth at $87\frac{1}{2}$ cents per bushel?

4. In a mixture of breakfast tea there are $18\frac{1}{2}$ pounds Oolong, which is $12\frac{1}{2}\%$ of the whole amount mixed. How many pounds in the mixture?

5. A farmer sold $62\frac{1}{2}\%$ of his lambs at \$4 $\frac{1}{2}$ each and received for them \$270. How many lambs had he?

6. I gained $12\frac{1}{2}\%$ by selling a village cart for \$10 more than cost. What did it cost me?

7. A grocer sold 80 barrels of apples at 20% profit and made \$45. What was the cost per barrel?

8. If a merchant sells goods at a profit of $16\frac{2}{3}\%$ and gains \$122.50, what was the cost of such goods?

9. \$42 $\frac{1}{2}$ was gained on a pile of 4-foot wood, 224 feet long, 6 feet high, which was 25% of the cost. What was the price paid per cord?

10. A farmer sold a span of horses to which he had fed \$50 worth of hay and grain for \$125 more than he gave for them, realizing a net profit of 25%. How much did he pay for the horses?

III.

1. I burned 15 gallons of kerosene oil, or 25 per cent. of my supply, in a single month. How much had I at first?

2. By selling a hat for \$1.60, 20 per cent. was lost. How many cents were lost?

3. What per cent. is gained by buying molasses at 25 cents a gallon, and selling it at 5 cents a pint?

4. An agent sells 50 barrels of flour at \$5 a barrel, and charges 3 per cent. for his services. How much did he receive for selling?

5. By selling tea at \$.40 a pound, 20 per cent. was lost. What per cent. would have been made by selling at \$.65?

1. $12\frac{1}{2}$ per cent. of the distance from Buffalo to New York City is 51 miles, 80 rods. What is the distance between the two cities?

2. The public school used 4 tons 15 hundred-weight of coal in a month, or 25% of the winter supply. How many tons were there in storage?

3. A broker sold 300 barrels of flour, charging a commission of $2\frac{1}{2}\%$. He received \$52.50 for his services. How much did he get per barrel for the flour?

4. The premium for insuring my property at $\frac{1}{10}\%$ is \$117. At what value is my property insured?

5. A farmer after selling 110 A. 43 sq. rd. of land, had 90% of his farm left. How many acres had he at first?

6. I sold my driving team, harness and carriages for \$280 more than cost, which was a net gain of 40%. What did they cost me?

7. What was the cost of a piano, which, when sold at a gain of $17\frac{1}{2}\%$, brought a clear profit of \$37.85?

8. A grocer sold 410 bushels of potatoes for \$98.40 more than cost, on which he made a clear profit of 25%. What did they cost him per bushel?

9. A lumber dealer sold 25650 feet of hemlock boards at a profit of \$3.20 on a thousand feet, and gained 20%. How much did he receive for the entire amount?

10. A stationer sold paper at 18 cents a quire and made a gain of 80%. What did his paper cost per ream?

IV.

1. *By selling a watch for \$60, I gained 20 per cent. on its cost. What did it cost me?*

2. *How many yards of cloth at three-fourths dollars a yard can be bought for \$2.25?*

3. *If a lad steps two feet at a time, how many steps will he take in going a distance of 2 rods 1 yard?*

4. *A stationer, by selling paper at a profit of 5 cents a quire, made \$4.50. How many reams did he sell?*

5. *How many surface feet in a rectangular piece of marble 4 feet long, 3 feet wide, and 2 feet thick?*

1. Mr. Owens sold a lot of cassimeres at \$3.25 and marked them *r. an*, his key being "Precaution." What was his gain %?

2. Flour sold at \$6 a barrel yields a profit of 20%. What does it cost per barrel?

3. A merchant sold a lot of damaged goods that cost him \$.42 a yard for \$.52½ a yard. What was his gain %?

4. A ship valued at \$30000 was owned jointly by two men. Mr. Davis who owned $\frac{3}{8}$ sold 10% of his share. What part of the ship does he still own?

5. A merchant sells flour at \$7.35 a barrel and makes 25%. What did it cost him per barrel?

6. A grocer sold 62 barrels of apples for \$138.88 at 33 $\frac{1}{3}$ % gain. What did they cost him per barrel?

7. Sold a cow for \$5 less than cost and lost 12 $\frac{1}{2}$ %. What was her selling price?

8. A carriage-maker sold a surrey for \$450 and thereby cleared 20%. What would he have gained by selling it for \$390?

9. A horse was purchased for \$250, which was \$25 less than its actual worth. If sold for \$25 more than its real value what would be the gain per cent.?

10. If 20% is lost by selling boards at \$9.60 per M. what per cent. would be gained by selling at \$1.50 per C.?

V.

1. If I buy tea at 80 cents a pound and sell it at \$1.20 a pound, what per cent. do I make?

2. What is the value of 7 dozen pairs of shoes at \$2.75 per pair?

3. What will be the cost of digging a ditch one mile long at \$1.75 a rod?

4. How many pounds of hay at \$15 per ton will \$8.40 buy?

5. A man sold a wagon for \$60 which was five-eighths of the original cost. How much did he lose?

1. Mr. Sampson bought a barrel of molasses for \$25 and sold it for \$31.25. How much did he gain per cent.?

2. A stationer buys paper at \$3.50 a ream, and sells it at 20 cents a quire. What is his gain per cent.?

3. A jockey sold two horses for \$270 each. On one he made $12\frac{1}{2}\%$, on the other he lost $16\frac{2}{3}\%$. What did they cost him?

4. An iceman bought 1650 tons of ice at \$8 per ton; 50% melted, and he sold the balance at \$.75 a hundred-weight. What per cent. was lost?

5. A man sold a carriage for \$185.60 and made 15%. What would he have lost by selling for \$152.25?

6. Having used a sleigh one winter I sold it for \$48, which was 20% below cost. What would I have received had I sold it for $16\frac{2}{3}\%$ above cost?

7. A grocer sold flour for \$3.22 per barrel and lost $12\frac{1}{2}\%$ per cent. What did it cost him?

8. If I sell 140 bushels of wheat for \$175 and gain 25%, how much per bushel should I have sold it to lose 20%?

9. A speculator sold two building lots for \$420 each. For one he received 25% more than its first cost and for the other 25% less than it cost him. How much did he lose?

10. A merchant sells $\frac{3}{4}$ of an article for what $\frac{1}{2}$ of it cost him. What per cent. does he lose on the part sold?

PERCENTAGE REVIEW.

I.

1. A farmer sold $6\frac{1}{4}\%$ of his farm of 240 acres for a cemetery, at \$225 per acre. How much did he receive for it?

2. From a barrel of flour 49 pounds had been used. What per cent. of the barrel remained?

3. A merchant receives from bills rendered, \$5850 and that sum is 75% of what is due him. How much is due him on the bills?

4. A carriage that cost \$128 was sold at a loss of $18\frac{1}{2}\%$. What was the amount received for it?

5. A merchant paid \$43.20 for a case of muslin, and sold the same at retail for \$50.40. What % did he make on the purchase price?

6. A harness-maker sold a riding outfit for \$50, which was afterwards sold at a loss of \$6.25. What was the loss per cent.?

7. A wholesale grocer bought a quantity of butter at 28 cents a pound and lost on his purchase $12\frac{1}{2}\%$. What was his selling price?

8. Mr. Love paid \$17.50 for a saddle and \$75 for a horse. The price of the saddle was what % of the price of the horse?

9. Paid \$4.80 per barrel for flour and sold it at \$6.00. What % was gained?

10. A merchant tailor purchased a piece of broadcloth containing 30 yards for \$52.50. How shall he mark it per yard, in order to gain 25%?

II.

1. A cow that cost \$40 was sold for \$50. What was the gain per cent.?

2. If a grocer buys flour at \$5 per barrel, at what price must he mark it so he may sell at a gain of 25%?

3. If I pay \$30 per case for $\frac{1}{2}$ -dozen pairs of boots and sell them at \$6.50 per pair, what % do I make?

4. By selling goods at $16\frac{2}{3}\%$ profit, a merchant clears \$1498. What was the cost of the goods?

5. A dishonest dealer added 2 gallons of water to every 38 gallons of milk. What per cent. did he cheat his customers?

6. A grocer sells tea at 30 cents a pound less than cost and loses $33\frac{1}{3}\%$. What was the cost?

7. $16\frac{1}{2}$ yards of velvet cost \$50.60. If sold at an advance of 20%, what should $2\frac{3}{4}$ yards bring?

8. For sawing a pile of wood 28 feet long, 6 feet high and 4 feet wide, I paid \$1.20 per cord, which was 25% of the cost of the wood. When sawed, what was the cost of the whole pile?

9. My lot, which contains 6 square rods of land, is what % of my neighbor's lot, which is 6 rods square?

10. If \$150 is $\frac{3}{4}$ of the cost of a carriage, what % will be gained by selling it for \$225?

III.

1. A boy buys chestnuts at \$5 a bushel, and sells them at 10 cents a pint. What % does he make?

2. At what price must a bookseller mark a book, which cost \$1.20, in order that he may make 25%?

3. A grocer buys 8 barrels of sugar, of an average weight of 230 pounds at $5\frac{1}{2}$ cents per pound. If he sells at 7 cents a pound, how much per cent. profit will he make?

4. A farmer sells 375 bushels of corn for 60 cents a bushel. The purchaser sells it at an advance of 25%. How much does he receive for it?

5. Paper that costs \$2.40 a ream, is sold for 18 cents a quire. What is the gain per cent.?

6. Mr. Dowden, the grocer, buys sugar at the rate of 24 pounds for \$1.00, and sells at the rate of 20 pounds for \$1.00. What is his gain %?

7. How much is made per pound on flour, which cost \$5.88 per barrel by selling at $33\frac{1}{3}\%$ profit?

8. R. M. Bowne's son bought a piece of cotton goods for $7\frac{1}{2}$ cents a yard, and sold it at 6 cents a yard. What was the loss %?

9. Mr. Peckham pays \$116.60 for \$5830 insurance. What rate % does he pay?

10. An auctioneer sells for me a carriage for \$140, a table for \$15, 50 yards of carpet at 60 cents per yard. His commission is $2\frac{1}{2}\%$, what will be due me for the goods?

IV.

1. For how much must silk, that costs \$1.20 a yard, be marked to gain 20%?

2. A dealer paid \$4 for hats and sold them at \$6 each. What per cent. profit did he make?

3. A merchant sold velvet at a loss of \$1 on each yard. If the loss was 20%, what was the cost per yard?

4. What % is gained by selling carpet at \$1.12 $\frac{1}{2}$, that costs \$.87 $\frac{1}{2}$?

5. A dealer sold coal at a profit of \$1.20 a ton, which gave a gain of 25%. What was the cost per ton to him?

6. A farmer sells his hay to a feed-man, who again sells it at a profit of \$2 a ton, and gains 25 %. What is his selling price?

7. If I buy corn for 60 cents a bushel, and sell it at 75 cents a bushel; and buy wheat at 80 cents and sell it for \$1 per bushel, upon which do I make the most %?

8. A stock dealer bought 200 cows at an average of \$35 per head and sold them for \$8000. What was his gain %?

9. Having some goods damaged by fire, I sold them at $66\frac{2}{3}\%$ less than cost. I received \$87.50 for them. What did they cost me?

10. At what price must I sell goods that cost $\$3\frac{1}{2}$ to gain 20%?

V.

1. A commission merchant sells 60 barrels of flour at \$4.50 per barrel. What is his commission at $6\frac{1}{4}\%$?

2. An agent sells 1600 yards of prints at \$0.03 $\frac{1}{2}$ per yard. What is his commission at $2\frac{1}{2}\%$?

3. 11 rods $5\frac{1}{2}$ feet is what per cent. of 4 rods and 2 yards?

4. What % was lost on a wagon which cost \$90 and sold for \$75?

5. A grocer bought butter at 27 cents a pound and sold it at a loss of $33\frac{1}{3}\%$. What was his selling price?

6. A commission merchant had 410 bushels of potatoes sent him, with orders to sell at 96 cents net per bushel. He held them until he received \$492 above his commission. What % was made by holding them?

7. A grocer pays \$61.20 for 15 cwt. 30 lbs. of sugar. His freight bill was \$7.65. At what price per pound must he sell the same to make a profit of 20%?

8. A merchant paid $18\frac{3}{4}$ cents a yard for flannel, and sold a farmer $12\frac{3}{4}$ yards for 16 dozens of eggs at 25 cents a dozen. What per cent. profit did he make?

9. A grocer bought 82 barrels of potatoes, which he afterwards sold for \$246, thereby gaining \$41. What was his gain %?

10. A horse, which was sold for \$250, would have given a profit of \$80 if the second owner had purchased \$30 dearer than he did. What was the % of gain to the first owner?

VI.

1. When silk was sold for \$2 there was a gain of $33\frac{1}{3}\%$. What was the cost?

2. By selling turnips $12\frac{1}{2}\%$ below the regular price I lose $5\frac{1}{4}$ cents a bushel. How much do I receive a bushel for them?

3. By selling a village lot for $16\frac{2}{3}\%$ profit I clear \$150. What did it cost me?

4. A watchmaker sold a watch for \$24 and gained 20% on its cost. What was the cost of the watch?

5. By selling flour at \$5.88 a barrel, $14\frac{2}{3}\%$ was lost. What was the cost per pound?

6. A man sells a book for \$1.25 and makes 25%. What did the book cost him?

7. I sold a horse for \$145, gaining 25%. Find what the horse cost me.

8. A merchant sold cloth for $\$1.87\frac{1}{2}$, being at a loss of $16\frac{2}{3}$ per cent. What was the cost?

9. A grocer sold 240 barrels of potatoes, containing 660 bushels at 70 cents a bushel, thereby losing $12\frac{1}{2}\%$. What was the cost of the whole?

10. A boy had two goats, which he sold for $\$6.00$ each. What did they cost him if he gained 20% on one and lost 20% on the other?

VII.

1. A man sells a city lot for $\$6410$ and makes $\$320.50$. What is the $\%$ gained?

2. For how much must butter, which cost $28\frac{1}{2}$ cents a pound be sold to gain 25% ?

3. A farmer sold a mower for $\$36$, losing 25% . Find the cost.

4. A merchant purchased 5 pieces of cloth of 35 yards each at $\$2.12\frac{1}{2}$ a yard. For how much a yard must he sell the whole to gain 25% ?

5. A man sold $12\frac{1}{2}$ dozen of hats for $\$200$ and lost 20% . What did they cost him apiece?

6. If I pay $\$751$ for goods and sell them at $6\frac{1}{4}\%$ loss, how much do I lose?

7. I sell goods that cost $\$45$ for $\$68.75$. What is the $\%$ of gain?

8. Raisins which cost $12\frac{1}{2}$ cents a pound were sold at a profit of $3\frac{1}{4}$ cents. What is the $\%$ gained?

9. What must be paid for 27 bushels of potatoes, that when sold at 20 cents a half-peck there may be a gain of 20% ?

10. Having purchased a farm for \$9000, and spent \$2500 in improvements, I sold it for \$13800. What per cent. did I make on my investment?

VIII.

1. A dealer sold 340 bushels of potatoes at 75 cents per bushel. If they cost him 60 cents a bushel what per cent. did he gain?

2. A farmer sold 45 bushels of corn, which was 75 % of what he raised. How much did he raise?

3. A house which cost \$4000 was sold for \$6000. What was the per cent. gained?

4. From a bill of merchandise amounting to \$1284, 6½ per cent. was deducted. What was the amount paid?

5. Mr. Gould sold his house and lot for \$3840, and by so doing cleared 20 per cent. on the first cost. What did the house and lot cost him?

6. What per cent. of \$90 is 33½ per cent. of \$67.50?

7. A man bought a barrel of pork for \$14.10 and sold it at a gain of \$2.35. What was the rate % gained?

8. A speculator bought 44 village lots for \$396.20 each, and sold them at an advance of 11½ per cent. How much did he receive for them?

9. A drover sold 40 head of cattle for \$1820, which was 16½ % more than their cost. What was the average cost of each?

10. A speculator sold two lots of land for \$180 each, on one he made 20% and on the other lost 20%. Did he gain or lose by the transactions and how much?

IX.

1. I sell goods that cost \$45 for \$56 $\frac{1}{2}$, what is the gain per cent.?
2. I sold my house for \$1500, and gained 25%. What did it cost me?
3. I sell a village lot for \$360, and lose 20%. What did it cost me?
4. A merchant bought a piece of cotton containing 40 yards at 6 cents a yard, and sold it for \$3. What was the gain per cent.?
5. The cost of an article is \$12.50, the profit on the sale is \$3.12 $\frac{1}{2}$. What is the rate per cent. of gain?
6. John Craig sells a horse for \$360, and gains 20% on what he paid for it. What per cent. would he have gained had he sold it for 10% less than \$360?
7. When the cost of flour is \$4.48 a barrel, and the expense of selling is 5 per cent., at what price must it be sold per pound to gain 25 per cent.?
8. A merchant bought 250 barrels of flour at \$5.50 per barrel, and sold it at a gain of 20%. What did he receive for the flour?
9. A miller sold 750 barrels of flour for \$7.50 a barrel, and made 25% on the wheat manufactured. What did the wheat cost him?
10. A grocer sold potatoes for \$2.80 a barrel, and made 16 $\frac{2}{3}$ %. If he had sold them for \$3.20 a barrel, how much per cent. would he have made on the cost price?

X.

1. What per cent. is gained in buying molasses at 80 cents a gallon, and retailing it at 12 cents a pint?
2. A boy sells a book for \$1.10, and thereby loses 12 per cent. What did the book cost him?
3. Find the cost of a piano, if $16\frac{2}{3}\%$ was lost by selling it for \$250.
4. For what must a grocer sell a barrel of flour that cost \$5.40, in order to realize a gain of $7\frac{1}{2}$ per cent.
5. A hatter sold caps for \$.50 less than cost, and lost $12\frac{1}{2}\%$. What did they cost him?
6. A grocer sold flour for \$.50 a barrel less than it cost, and lost $6\frac{1}{2}\%$. What was his selling price?
7. A lad bought 4 sheep, and sold 2 for \$12 thereby gaining $33\frac{1}{3}\%$, and the others for \$10, losing $16\frac{2}{3}\%$. What did he gain in the transactions?
8. I gained 25% in selling a horse and with the money bought another horse which I afterwards sold for \$120, losing 20%. Did I gain or lose by the transactions and how much?
9. A commission merchant received a consignment of 400 bales of hay, averaging 195 pounds to the bale, and sold it at \$15 a ton. If he charge $2\frac{1}{2}$ per cent. commission how much will his principal receive?
10. A man sold a harness for \$15 and lost $16\frac{2}{3}\%$. If he had sold it at a profit of 20% what would he have received?

XI.

1. If 34 boxes of raisins cost \$29 $\frac{1}{2}$ what per cent. of a box can I purchase for 12 $\frac{1}{2}$ cents?

2. Mr. Howard owned $\frac{1}{4}$ of a tin factory. He sold 12 $\frac{1}{2}$ % of his share for \$1500, which was 20% less than its full value. How much was the value of the factory?

3. A merchant tailor bought cloth at \$3.00 per yard and sold it at \$5. What was the per cent. of profit?

4. A person having bought a bill of books listed at \$360, received a discount of 16 $\frac{2}{3}$ % from the bill. How much did he pay?

5. A grocer bought butter at 24 cents per pound and sold at a loss of 25%. What was the price obtained per pound?

6. Mr. Selden buys flour at \$6 per barrel and sells it to make \$1.50 per barrel. What is his per cent. of gain?

7. A book seller buys 24 Hutchinson's Physiologies for \$25.92. At what price must he retail them to gain 33 $\frac{1}{3}$ per cent.?

8. What is my commission on sales of \$1506.76 at 2 $\frac{1}{2}$ per cent.?

9. By selling 400 barrels of apples at \$5 a barrel I make 25%. How much did the apples cost me?

10. By selling cloth at \$3 per yard 25% was lost. What % would have been gained if sold at \$4.25 per yard?

XII.

1. What per cent. is taken by selling 15 ounces of tea for a pound?

2. A grocer purchased 640 pounds of sugar at $7\frac{1}{2}$ cents per pound and sold it at a profit of $12\frac{1}{2}\%$. What was the gain?

3. By selling nails at \$3 a keg 25% was made. What was the cost of 25 pounds?

4. A provision merchant sold 400 barrels of beef for \$6000 which was a loss to him of 25% . What did the beef cost him per barrel?

5. A grocer sold 20 barrels of flour for \$5.50 a barrel and made on the same 25% . How much did the flour cost the grocer?

6. In 1891 a farmer had 150 sheep. The next year this number was increased by $33\frac{1}{3}\%$, and the whole number sold for \$4.25 a head. How much did the farmer receive for his flock?

7. A merchant sold his last year's stock of hats for \$1.00 per doz. less than cost, and lost $12\frac{1}{2}\%$. What did they cost him by the dozen?

8. A dealer sold a span of horses for \$300 each. On one he made 25% , but lost 20% on the other. What was his loss on the team?

9. If 20% was gained on flour when sold at \$6 a barrel, what per cent. was gained when sold at \$7 a barrel?

10. A lumber dealer sold 123250 feet of lumber at \$18 a thousand, and gained 25% . How much would have been his entire gain had he sold it at \$16 a thousand?

XIII.

1. A merchant sold goods that cost him \$500, for \$620. What was his gain per cent.?

2. A man paid \$210 for a horse which was 30% less than what a carriage cost him. What did he pay for both?

3. By selling a cart for \$49.50 a profit of $12\frac{1}{2}\%$ was made. What was the first cost of the cart?

4. A grocer sold sugar for $4\frac{1}{2}$ cents a pound that cost him 5 cents. What per cent. did he lose?

5. I made \$20 on a cow by selling her at an advance of 25%. What did she cost me?

6. If $\frac{4}{5}$ of a barrel of flour was sold for what the whole cost, what was the gain per cent.?

7. A sleigh that cost \$45 was sold for \$40. What was the loss per cent.?

8. By selling goods for \$23.31 a profit of 11% was made. What was the first cost of the goods?

9. A miller sold 6000 bushels of wheat at 80 cents a bushel and thereby lost 20%. What did the wheat cost him?

10. A grocer paid \$16 for a barrel of mess pork and retailed $\frac{3}{4}$ of it at 12 cents a pound; and the balance at 10 cents a pound. What per cent. did he make?

XIV.

1. If I sell a sleigh for \$15 that cost me \$25 what per cent. do I lose?

2. What was the cost of cloth marked \$3.50 per yard at 25% advance on the cost?

3. A stationer bought legal cap paper at \$2.40 a ream and sold it at 30 cents a quire. What was his gain per cent.?

4. A grocer by selling flour for \$6.12 $\frac{1}{2}$ a barrel, lost $12\frac{1}{2}\%$. How much did it cost him?

5. A merchant marked prints which cost him $3\frac{1}{2}$ cents a yard to be sold at $4\frac{1}{2}$ cents. What per cent. advance on the cost was this?

6. A flour merchant, by selling flour at \$6.25 a barrel, makes 25%. What did the flour cost him?

7. When goods are sold at $\frac{3}{4}$ of their cost what per cent. is lost?

8. If a seedsman sells 3 pecks of Alfalfa seed for what one bushel cost him, what per cent. does he make?

9. A grocer by retailing pork at $12\frac{1}{2}$ cents per pound, made 10% on the cost. What was the cost per barrel?

10. If a grocer pays \$2 for 6 pounds of tea and sells 4 pounds for \$3, what is his per cent. of profit?

XV.

1. I purchased 320 barrels of flour at \$4.25 per barrel. For how much must I sell the whole to gain 25%?

2. A boy sold pop-corn for 15 cents a quart and made a profit of 50%. What did the corn cost him per bushel?

3. Jones & Co. receive a consignment of 2000 barrels of apples, which they sell at \$2.25 a barrel, paying \$37 storage and \$13.50 cartage. Their commission is $2\frac{1}{2}\%$. How much should they remit to the shipper?

4. What per cent. of a mile is 62 rods 1 yard 14 feet?

5. I bought a house for \$2250 and sold it for \$2700. What per cent. did I gain?

6. A grocer purchased 62 barrels of potatoes, which he sold for 20% more than they cost and gained \$24.80. How much did he receive per barrel for them?

7. A grocer bought a quantity of sugar, but, finding it damaged, sold it at a loss of 20%. He received \$340 for it. What did it cost him?

8. If tea sells at 60 cents a pound and a gain of 20% is made, how much is the gain per cent. when sold at \$.70 a pound?

9. A man sold a horse for \$240 by which he gained 20% on its cost. What would have been his gain had he sold it for \$300?

10. If 20 per cent. is gained on flour, when sold for \$6 a barrel, what per cent. would be gained if sold for \$6.50 per barrel?

XVI.

1. A coal merchant sold 60 tons of coal on which he made \$75, which was 25% of the cost price. How much did he receive for the entire amount?

2. A clerk sold 5 yards from a piece of silk for \$7.50 which was 25% above cost. What was the cost of the whole piece, which contained 32 yards?

3. Mr. Graham, having used his carriage 3 years, sells it for \$375, which was $33\frac{1}{3}\%$ below its first cost. How much did he pay for it when new?

4. By selling hay at \$9 a ton I lose 10%. At what price must I sell to gain 15%?

5. A grocer having 6 cwt. 25 lbs. of sugar, sold $\frac{1}{4}$ per cent. of it to a customer at $5\frac{1}{2}$ cents a pound. How much did he receive for it?

6. Harry purchased a sleigh for \$90 and after using it one winter, sold it for $\frac{3}{4}$ of its first cost. What per cent. did he lose?

7. By selling cashmere at \$1.40 per yard, a merchant gains 16 $\frac{2}{3}$ %. What is his gain on a sale amounting to \$42?

8. I bought two village lots for \$450 and \$350 respectively, and sold them for \$500 each. What per cent. did I gain?

9. Mr. Charles Post sells $\frac{3}{4}$ of an acre of land for what $\frac{1}{2}$ an acre cost him. What was his loss per cent.?

10. I bought a carriage for \$240, and immediately sold it for \$260. The purchaser being dissatisfied I bought it back for \$200. What per cent. did I make by the transactions?

XVII.

1. A harness which cost \$50 was sold for \$40. What per cent. was lost?

2. A lady sold her horse and carriage for \$700, losing \$100. What per cent. did she lose?

3. A farmer sold a span of horses for \$425, gaining 25% on their cost to him the previous year. What did they cost him?

4. A grocer bought a cask of molasses containing 60 gallons for \$25. A fifth of the molasses having leaked out, he sells the remainder at 50 cents a gallon. What is his per cent. of loss?

5. A farmer sold a cow for \$50, which was 80% of the cost price. What was his loss?

6. Mr. Taff sold two village lots at a gain of \$200. He received \$1000 for both. What per cent. was made?

7. A clerk sold from a piece of silk 20 yards at \$1.50 a yard, which was 20% more than it cost the merchant. What was the cost of the whole part sold?

8. A merchant sold hay for \$14 a ton and gained 16 $\frac{3}{4}$ per cent. What per cent. would he have gained if he had sold at \$13.00 a ton?

9. By selling oranges at \$2.25 a box, 6 $\frac{1}{4}$ % was lost. What per cent. would have been gained by selling at \$2.50 a box?

10. A lumber merchant sold 73680 feet of lumber at \$20 per M. and gained \$294.72. What was his per cent. of gain?

XVIII.

1. A grocer bought eggs at 42 cents a dozen and sold them at the rate of 5 for \$0.25. What per cent. did he make?

2. If 25 per cent. is gained on flour when sold at \$5.00 a barrel, what per cent. would be gained when sold at 3 cents a pound?

3. A farmer raises 150 lambs at an expense of \$375. For how much must he sell them per head to make 20% on the outlay?

4. A miller bought 500 bushels of wheat at 75 cents a bushel and manufactured it into flour, taking 5 bushels for a barrel. At what price must he sell the flour per barrel to gain 20%?

5. A grain merchant sold 5520 bushels of corn at 50 cents a bushel and lost 6 $\frac{1}{4}$ %. How much per cent. would he have gained had he sold it all for \$3312?

6. A flour merchant sold 116 barrels of flour at \$6.00 per barrel, and thereby lost 16 $\frac{3}{4}$ %. What per cent. would he have made had he sold it for \$939.60?

7. By selling a village lot for \$160, I lost 25%. At what price should I have sold it to have made 20%?

8. What per cent. of $\frac{1}{2}$ barrel is $1\frac{1}{2}$ gallons. What per cent. of 5 pounds of tea is 12 ounces?

9. I sold my reaper for \$156 and thereby lost \$52 on the purchase price. What was the per cent. lost?

10. A merchant sold broadcloth at \$3.50 a yard and gained $16\frac{2}{3}\%$. What per cent. would he have gained or lost had he sold it at \$4.00 a yard?

XIX.

1. Lord & Taylor sell lace curtains at \$10 per pair and thereby gain 25%. What did the curtains cost them?

2. A grocer purchased 15 barrels of pork at 8 cents a pound and retailed it at an advance of 25%. What did he receive for it?

3. James Hicks sold a cow for \$72 and gained $12\frac{1}{2}\%$. What per cent. would he have gained or lost had he sold her for \$56?

4. A tea merchant mixes 15 chests of tea at \$20 a chest, with 18 chests at \$15 per chest, and sells the mixture at \$20 per chest. What per cent. does he gain?

5. By selling potatoes at a profit of 25 cents a barrel, a grocer realizes a gain of $12\frac{1}{2}\%$. How much did 80 barrels cost him?

6. When flour is selling at \$4.50 per barrel, a miller loses 10%. What would be his gain per cent. if he sold at \$5.50 per barrel?

7. A druggist gained 300% by retailing quinine at \$3.00 per ounce. How much did it cost him per ounce?

8. In the summer of 1889 I built two houses which sold for \$2100 each; on one I made $16\frac{2}{3}\%$, and on the other I lost $12\frac{1}{2}\%$. Find the net gain.

9. A grocer bought 164 barrels of potatoes which he afterwards sold for \$492, thereby gaining \$82. What was his per cent. of gain?

10. A merchant sells his boots for \$3.60 a pair and makes 20 per cent. What per cent. would he have made if he had sold them at \$4.00 a pair?

XX.

1. A sleigh, which cost \$28, was sold at a loss of \$5.04. What per cent. was lost?

2. If $12\frac{1}{2}$ hundred-weight of sugar cost \$70, at what price must it be sold per pound to gain 25 per cent.?

3. Mr. Hatch bought 500 shares mining stock for \$9000, and sold all but 100 shares for what he paid for the whole. What per cent. did he make?

4. If a merchant sell 1 bushel and 1 peck of clover-seed for what $1\frac{1}{2}$ bushels cost, what per cent. is gained?

5. A grocer by selling tea at \$0.48 a pound, gains 20%. What did a chest of 80 pounds cost the grocer?

6. A trader bought a 4-foot pile of wood, 6 feet high and 256 feet long at \$4.50 per cord, and sold his entire purchase for \$270. What per cent. did he make by the transactions?

7. A farmer sold 4 cows for \$36 each. On 2 of them he gained 20% and on the other 2 he lost 20%. Did he gain or lose and how much?

8. John McBrian sells a Jersey cow for \$99, which was 10% less than his asking price. His asking price was 10% more than the first cost. What did the cow cost Mr. McBrian?

9. A market-woman bought 100 Florida oranges for \$2.50. How should she price them each, that she might fall $33\frac{1}{3}\%$ and still make 20% profit?

10. I bought sleds marked on list at \$12 per dozen for $\frac{1}{2}$ and 10% off, and sold them at retail at \$1.00 each. What per cent. did I gain?

11. A grocer bought 9 barrels of sugar, each weighing 340 pounds at $3\frac{1}{2}$ cents a pound. How much profit would he make if he sells at $4\frac{1}{2}$ cents per pound?

12. A merchant bought 130 barrels of flour at \$5.50 a barrel and sold it at a gain of \$85. What was his gain per cent.?

13. An importer received \$7224 worth of goods, on which there were \$104 charges. He sold them at an advance of 20%. What was his profit?

14. If I buy apples at 90 cents a barrel and sell them at \$1.20 per barrel, and potatoes for $\$1.12\frac{1}{2}$ a barrel and sell them at \$1.50 a barrel, upon which do I make the greater per cent.?

15. A farmer sold 1380 bushels of wheat at \$1 per bushel and lost 8 per cent. How much per cent. would he have gained had he sold at \$1.20 a bushel?

TRADE OR COMMERCIAL DISCOUNT.

ILLUSTRATIVE EXAMPLE.

I asked a bookseller the price of Webster's Unabridged Dictionary. He answered, "The list price is \$12, but I can allow you a discount of 25%." What did he ask me for the book?

By a discount of 25%, he meant 25% less than \$12, or \$12 — \$3, or \$9. The \$3 is called the Trade Discount.

I.

1. A Board of Education bought a bill of books of Smith, Wood & Co. amounting to \$25, with a trade discount of 20 per cent. and 5 per cent. off for cash. What was the net amount of the bill?

2. A gain of \$5 on goods that sold for \$25 is a gain of what per cent?

3. At 6.5 cents a pound how much rice can be bought for \$6.50?

4. A broker sold cotton to the amount of \$540 at 2.5 per cent. commission. How much did he receive for his services?

5. In selling a horse for \$180, a man gained 20 per cent. of the cost. What was the first cost?

1. Having bought a bill of goods on time amounting to \$150, the tradesman said to me: "For cash I will give you 5% discount on this bill." What amount of ready money would pay the bill?

2. I bought a bill of books of A. Lovell & Co., billed at list prices. The amount of the bill was \$450. What was the net cash value of the books, if they allow me a discount of 10% and 5% off for cash?

3. Which is the better a discount of 25% and 10% off the remainder, or a discount of $33\frac{1}{3}\%$? If the latter discount is accepted, instead of the former, would I gain or lose on a bill of goods amounting to \$500 and how much?

4. What is the retail price of a book which cost me \$3.30, if the bookseller gave me a discount of 25% from the retail price?

5. Find the amount of the following bill.

New York, Jan. 2, 1892.

Wm. P. Maxwell,

Bo't of AMERICAN NEWS Co.

200	Monteith's Complete Geographies	at \$1.20, 10%	
60	Barnes' U. S. Histories	at .90, $12\frac{1}{2}\%$	
6	Cases Hyatt's Pat. Slates	at 8.00, 25%	
40	doz. P. D. S. Copy Books	at 1.00, $16\frac{2}{3}\%$	

A discount of 2% was allowed for cash.

6. The Teachers' Publishing Co., New York City, bought of J. B. Lippincott Co., Philadelphia, the following bill of goods with a discount of 30%, 10% and 5%. What was the cost of the books? 10 Dickens, People's Ed., 15 vols. at \$22.50; 7 George Eliot, 20 vols. at \$35; 13 Thackeray, Globe Ed., 12 vols. at \$15; 4 Charles Reade, 17 vols. at \$21.15; 36 The "Duchess" novels at \$1.

COMMISSION.

1. How much should be received by an agent for selling \$500 worth of goods, if 3% is allowed for his commission?

OPERATION : $\$500 \times .03 = \15.00 Commission.

2. A flour merchant sends his agent \$2100 to invest in flour, at \$4 per bbl., after deducting his commission of 5%. How many barrels of flour will the merchant receive?

ANALYSIS: If \$2100 is $\frac{100}{95}$, 1% is $\frac{1}{105}$ of \$2100, or \$20. 100% is \$2000, or the investment.

NOTE: In business operations there is really no such example as the above. We give a few for the mental exercise they afford the pupil.

I.

1. A commission merchant received \$105 for selling butter at 5 per cent. How much did the butter bring?

2. How shall I mark gingham that costs 12 cents a yard to make 25 per cent.?

3. If 75 per cent. of a yard of cloth cost \$1.20; what is the cost of 40 per cent.?

4. What will a barrel of vinegar cost at 5 cents a pint?

5. I sold a watch for \$25 and gained 25 per cent. What per cent. would I have gained or lost if I had sold it for \$21?

1. A New York commission house sells 120 bales of cotton at \$42 a bale and charges a commission of $1\frac{1}{2}\%$. How much must they pay over to the principal?

2. I directed a real estate dealer to sell 50 lots of ground at \$350 a lot. If he charge 2% commission for selling and \$5 a lot for guaranteeing the title, how much will I receive for my lots?

3. How many barrels of flour at \$5 a barrel can be bought for \$3075, if $2\frac{1}{2}\%$ commission be allowed on the money paid out?

4. How many barrels of flour at \$6 per barrel can a broker buy for \$882, after deducting his commission of 5%?

5. I paid an agent \$57.82 $\frac{1}{2}$ for collecting a bill at $4\frac{1}{2}\%$. How much was the claim?

6. \$26.86 commission for selling \$792 worth of goods is what per cent. commission?

7. A broker sells 4000 bushels of wheat, and remits by check \$4,900 after deducting his commission of 2%. At what price per bushel did he sell the wheat?

8. I sent a commission agent 400 barrels of potatoes, which he sold at \$2.25 per barrel. His charges were: commission $2\frac{1}{2}\%$; storage $1\frac{1}{2}\%$; cartage \$8.25. How much was due me?

9. A farmer forwarded 60 barrels of potatoes to New York City which were sold at \$2.25 per barrel. The broker charged \$5.25 for cartage and a commission of 2% for buying. He invested the proceeds in coal at \$5 per ton. How many tons of coal did the farmer receive, and how much money was left for him?

10. An agent sold sugar for a Southern merchant to the amount of \$1200 and invested the *net proceeds* in flour at \$5 a barrel, less a commission of $2\frac{1}{2}\%$, in both cases. What was the *whole* commission on sales and investment?

INSURANCE.

Insurance is of several kinds, and is against loss of property, accident, loss of health, and loss of life. The **premium** is a stipulated sum paid for the insurance by the party insured.

I.

1. *A house valued at \$800 was insured for three years at 1 and one-quarter per cent. What was the premium or cost of insurance?*

2. *If I pay \$12.50 for having my house insured at five-eighths per cent., for what amount do I get it insured?*

3. *I paid \$7.50 for a load of coal at \$5 per ton. How much did it weigh?*

4. *A man sold a carriage for \$240, losing 20 per cent. Find the first cost.*

5. *My house lot is 4 rods front and 5 rods deep. What per cent. of an acre is it?*

1. *A merchant insured \$3600 worth of goods in one company at $\frac{1}{3}\%$ premium; \$2500 in another at $\frac{1}{4}\%$ premium. What was the cost including \$1 for each policy?*

2. *A merchant insured a cargo of goods from Liverpool for £2000 at a premium of $1\frac{1}{4}\%$. What was the cost of insurance, including £ $\frac{1}{2}$ for policy, the £ being valued at \$4.86?*

3. Mr. I. J. Merritt's paint factory is insured for \$60000 at $2\frac{1}{2}\%$, which is the full value. If the factory should be burned the following week what loss would Mr. Merritt *actually* sustain?

4. A vessel valued at \$75000, with its cargo valued at \$100000, was insured in the Liverpool Marine Insurance Company. The vessel and cargo were each insured for $\frac{2}{3}$ of their value at $2\frac{1}{2}\%$. What was the premium? What would be the loss to the insurance company if the vessel and cargo should be lost at sea?

5. January 1, 1873, a man took out an insurance policy on his life in the Rochester Mutual, in favor of his wife, paying \$21.30 yearly on \$1000. If the man died February 1, 1881 how much more did the widow receive than had been paid by her husband?

6. A merchant paid \$36.50, including \$1.00 for policy for the insurance of \$3600 on merchandise. What was his rate of insurance?

7. A house was insured for $\frac{2}{3}$ its value at $\frac{3}{4}\%$. The premium was \$13.50. What was the value of the house?

8. What is the amount paid for insurance on $\frac{3}{4}$ of a factory valued at \$60000 at $1\frac{1}{2}\%$?

9. An importer insures 225 pieces of silk velvet, each piece containing 40 yards, valued at \$3.50 a yard. He paid \$1323 for the insurance. What was the rate per cent?

10. The owner of a store insures for \$16750 at $\frac{3}{4}\%$. What would be his actual loss if destroyed by fire?

STOCK INVESTMENTS.

In the year 1889 the inhabitants of the flourishing village of Flushing, N. Y., were desirous of connecting with College Point by a street railway. Some of the business men of the village of Flushing offered to subscribe the money necessary to build the road, with the understanding that each should receive from the yearly earnings, a sum proportional to the amount of the cash put into the construction fund. The money so subscribed was called the *stock* of the Company. A certificate was given to each subscriber, stating how many *shares* belonged to each—every share representing \$100. During the first year the road earned nothing, and it was found necessary to issue 160 shares of stock, which were sold in the market at a discount of 14%, brokerage for selling being $\frac{1}{8}\%$. How much cash did the Company receive on this sale of stock?

ANALYSIS:—

One share will bring $86\% - \frac{1}{8}\%$, or $85\frac{1}{8}\%$ of \$100, = \$85.87 $\frac{1}{2}$. 160 shares will bring \$13740.

During the year following, the road did such a fine traffic, it declared a dividend of 12% on the face of its stock; and as a consequence many were desirous of put-

ting money into the road, and anxious to purchase shares *above* their *par* value (\$100 each). Several shares were sold for \$108, or at a premium of 8%. Some speculators wishing to buy the stock as low as possible, started all kinds of rumors about the condition of the two villages, and tried in every way possible to make the stockholders believe that the road would be a failure, and their stock would not earn 5%,—less than the legal rate of interest. These persons were trying to “*bear*” down or depress the price of the stock, and were known as the *Bears* of the Stock Market. After they had succeeded in getting a large amount of the stock into their possession they employed a *Stock Broker* (a person who makes a business of buying and selling stocks) to sell for them at a commission of $\frac{1}{2}\%$. It was found at the end of the second year that the road *was* still a good paying investment. These same people, who had been “bearing” the market, now began to “boom” the road, trying to make the price of stock high, (“toss them up” as it were). They became what were known as *Bulls* of the Stock Market.

I

1. Find the cost of 12 shares of L. I. R. R. Stock at a discount of one-fourth per cent.; brokerage one-fourth per cent.?

2. How many shares (\$100 each) of N. Y. O. & W. R. R. Stock at 108 and three-fourths may be bought for \$218?

3. John can build a tank in 4 days, and William in 6 days. How long would it take them when working together?

4. A lot 8 rods square is what per cent. of an acre?

5. If 3.5 dozen pineapples cost \$3.50, what will three-fourths of a dozen cost?

FIND THE VALUE OF SHARES.

1. Mr. Arthur M. Butts buys, through a broker, 48 shares of Flushing and College Point Street R. R. stock at an advance of 14% *above par*. What does it cost him?

ANALYSIS:—

One share will cost $114\% + \frac{1}{8}$, or $114\frac{1}{8}\%$ of \$100 = \$114.12 $\frac{1}{2}$. 48 shares will cost $48 \times \$114.12\frac{1}{2} = \5478 .

2. What cost 50 New York, Ontario and Western Railway 6% bonds, quoted at 34 $\frac{1}{2}$?

3. What costs a \$1000 U. S. Bond, 6's of '81 at 116 $\frac{1}{2}$?

4. Find the cost of 400 shares of the Manhattan Beach R. R. stock, the selling value of which is 97 $\frac{3}{4}$, brokerage costing $\frac{1}{4}\%$?

5. Henry Clews & Co. purchased for me 40 shares of N. Y. C. & H. R. R. stock at 96 $\frac{1}{2}$, charging me $\frac{1}{8}\%$ brokerage. What did I pay for the 40 shares?

FIND THE NUMBER OF SHARES.

6. How many shares of N. J. Central R. R. stock at 105, brokerage $\frac{1}{4}\%$, can be bought for \$2526?

ANALYSIS:

Since the stock was bought at 5% premium, or 105 % of its face value increased by $\frac{1}{4}\%$ brokerage, each share will cost \$105.25. As many shares can be bought for \$2526 as \$105.25 is contained times in it, or 24 shares.

7. How many shares of the Northern N. J. R. R. stock at 107 $\frac{3}{4}$, brokerage $\frac{1}{4}\%$, can be bought for \$5400?

8. I wish to invest \$21560 in the Chicago & North Western R. R. stock at $97\frac{1}{4}$, brokerage for same being $\frac{1}{4}\%$. How many shares can I buy?

9. How many \$1000 U. S. bonds, 6's of 1881 at $117\frac{1}{4}$, brokerage $\frac{1}{4}\%$, can I buy with \$23500?

10. How many shares of the Michigan Southern R. R. stock, at a discount of $1\frac{1}{2}\%$, can be bought with \$28565, brokerage being $\frac{1}{4}\%$?

II.

1. How much 4 per cent. stock at par must be bought to give an income of \$24?

2. If a person buys 6 per cent. stock at 120, what rate of interest does he receive on this money invested?

3. What will 10 shares of railroad stock cost at an advance of 20 per cent., no brokerage?

4. Oats cultivated at an expense of 20 cents a bushel are sold at 1 cent a pound. What is the gain per cent.?

5. A mile of wire will cost how much at 5 cents a half-rod?

FIND AMOUNT OF INVESTMENT.

1. How much must I invest in U. S. bonds, 5's at 108, to secure to my wife an annual income of \$1500?

ANALYSIS:—

Since the income of \$100 is \$5 annually, to produce \$1500, annually, there must be as many \$100 bonds at par, as \$5 is contained times in \$1500, or 300. $\$100 \times 300 = \$30,000$ at par. As the bonds are selling at 108%, or 8% above par, they will cost 1.08 times \$30000, or \$32400.

2. The Glen Cove Manufacturing Company's stock is worth \$122, and pays an annual dividend of 10%. How much must be invested to yield an annual income of \$1350?

3. Mr. Wheaton wishes to make a permanent investment for his invalid son William, that he may have an annual income of \$1620. What sum must he invest in U. S. bonds at $4\frac{1}{2}\%$, selling at 102, to provide such an income?

4. What sum of money must I invest in a 4% Hackensack water-bond of 1880, which sells at $70\frac{3}{4}$, brokerage $\frac{1}{4}\%$, to provide an income of \$720 each year?

5. I desire to invest in Baltimore & Ohio R. R. bonds, which bear interest at 7%, a sum sufficient to produce an annual income of \$1400. If the bonds can be bought at a discount of $10\frac{1}{2}\%$, how much money must I invest, brokerage being $\frac{1}{4}\%$?

FIND RATE OF INCOME.

6. I have 10 \$100 school bonds of 1872, bearing interest at 8% annually, which I purchased at \$110 each. What is the rate per cent. on the investment?

ANALYSIS:—

Since \$100 of the bond cost me \$110, and the income from it is \$8, the income is $\frac{8}{110}$, or $\frac{8}{11}\%$, or $7\frac{2}{11}\%$.

7. A gentleman owning 200 shares of L. I. R. R. stock, receives in 1889 an annual dividend of \$1600. What was the rate?

8. If I buy a 6% town bond at 112, what is my rate of income?

9. Which is better for me to invest, in 7% Flushing school bonds at 105, or 6% Michigan Central R. R. bonds at 84?

10. I purchased a house in 1884 for \$3000, which I rent for \$25 per month. I pay \$90 for taxes and \$30 for repairs each year. How much better income would I have received had I taken the advice of my friend and bought 6% first mortgage bonds of Ontario & Western R. R. at 75?

III.

1. *What must I pay for 4 per cent. stock that the investment may yield me 5 per cent.?*

2. *How much would be received for 24 shares of railway stock (\$100 each) at 75?*

3. *What will be the cost of 10 shares of Boston & Maine R. R. stock at 125?*

4. *If a man purchases 7 per cent. stock at 140, what rate of interest will he receive on his money?*

5. *A person received 4 per cent. interest on his money by investing in some six per cent. stock. At what price did he buy it?*

FIND THE MARKET VALUE OF STOCK.

1. What must I pay for 5% stock that the investment may yield 8%?

ANALYSIS:—

Since 5% stock will yield \$5 income on the par value of one share, \$5 then must be 8% of the price to be paid for it. One per cent. of the price to be paid is $\frac{1}{8}$ of \$5 or \$ $\frac{5}{8}$, or 62 $\frac{1}{2}$ cents. 100 per cent. of the price is 100 times 62 $\frac{1}{2}$ cents, or \$62.50.

2. What do I pay for 5% stock when the investment yields me 4%?

3. What must be paid for N. J. Midland R. R. stock, paying 6%, to receive an income of $7\frac{1}{2}\%$?

4. What premium may I pay for Ninth National Bank stock, which declares a dividend of 10%, so as to realize $7\frac{1}{2}\%$ on the investment?

5. I hold a 6% mortgage bond for \$1500 and wish to place it in $4\frac{1}{2}\%$ school bonds of \$100 each. How many must I buy that my income may be the same?

6. What is the currency value of \$85000 in gold, when gold is selling at 103 $\frac{1}{4}$?

7. Find the currency value of \$3700 of gold quoted at 102 $\frac{3}{4}$.

8. Find the value in gold of \$2500 in currency, when gold is at a premium of 5%.

9. When gold is selling at 105 $\frac{1}{4}$ what is the gold value of \$8420 in currency?

10. A man bought some bank stock at 108 $\frac{1}{2}$, and received \$275 when a 5% dividend was made by the bank. How much money did he invest?

SIMPLE INTEREST.

I.

1. The computation of interest affords one of the most common applications of the problems of percentage, in which time enters as a factor. The pupil should thoroughly understand what is meant by "interest at ten per cent. per annum." It simply means that for the use of anything for one year, ten per cent., or $\frac{1}{10}$ of that thing is to be allowed.

One method for computing interest, made perfectly familiar, is sufficient and immeasurably better than a superficial knowledge of three or four. We therefore present but one, the six per cent. method.

ILLUSTRATIVE EXAMPLE.

C. A. Barnes loans me \$500 for one year, two months, and twelve days. I agree to pay him back the \$500 at the close of the above time and 6% per annum additional for the use of the money. How much shall I pay for the use of the money, and how much shall I pay in all to Mr. Barnes at the end of the time?

At 6% per annum the interest of \$1.00 for 12 months is 6 cents or .06 of the principal. For 2 months or $\frac{1}{6}$ of 12 months it is 1 cent, or .01 of the principal.

For 12 days, or $\frac{1}{10}$ of one month, it is $\frac{1}{10}$ of one cent, or .002 of the principal.

At 6% interest for the whole time on \$1. is \$0.072.

OPERATION:

$\$500 \times .072 = \36.00 , money to be paid for the *use* of the \$500 borrowed. The whole amount to be paid to Mr. Barnes is \$536.

What is the interest on \$150 for 1 year, 3 months, 15 days at 6%?

ANALYSIS:

Int. of \$1. for 1 year at 6% is .06.

" " \$1. " 3 months at 6% is .015.

" " \$1. " 15 days at 6% is .0025.

The sum of these, .0775, is the interest of \$1. for the given time at the given rate, and, since the interest of \$1. is \$.0775, the interest of \$150 is 150 times that sum, or \$11.625.

OR

The interest on \$1. at 6% is \$.06 for one year, or twelve months, or *one-half cent* per month; for the 3 months, it will be as many cents as $\frac{1}{4}$ the number of months, or \$.01 $\frac{1}{4}$. As the interest is *five mills* (.005) for 30 days, or 1 month, for 6 days it will be *one mill*; for the 15 days, it will be as many mills as $\frac{1}{2}$ of the number of days, or *two and one-half mills* (.002 $\frac{1}{2}$). The interest for \$1.00 for the given time is therefore \$.0775.

I.

1. A merchant borrowed \$800 for 3 years at 10 per cent. per annum, or \$10 for every one hundred dollars for each year. How much will he have to pay for the *use* of the money?

2. What is the interest on \$350, borrowed for 3 years and 4 months, at 6 per cent.?

3. A farmer hires \$600 on his note due in 1 year at 6 per cent. How much interest will he have to pay?

4. A gentleman bought a span of horses for \$1800, paying \$1000 down. For the balance he gave his note for 2 years, 4 months at 6 per cent. interest. What was the amount due on the note?

5. I bought a house and lot in Flushing for \$4500, paying \$2000 cash. I gave a mortgage for the balance, due in 3 years, 6 months at 6 per cent. What was the amount of the mortgage when due?

6. A grocer hires \$400 at 6 per cent. *interest*, and with it purchases pork at \$16 a barrel. During the next 14 months he sold it *all* at an advance of 25 per cent. How much was his net gain?

7. A gentleman sold a house that cost him \$1500 at an advance of 20 per cent. He kept the house three years, receiving only \$100 annual rental above taxes, insurance, and repairs. How much did he gain if money earns 10 per cent. per annum?

8. A farmer sold a piece of land for \$900, which was \$100 more than he paid for it. He held the land 1 year and 6 months receiving \$75 for the use of it besides taxes. What was his net gain if money was worth 6 per cent.?

9. I loan a merchant \$600 for 3 years at 6 per cent., and trade with him during the time to the amount of \$275; how much will he pay me back if he charges no interest on the goods sold me?

10. I hired \$8500 in New York City at 6 per cent., and loaned it in Beloit, Wis., at a rate which produced me \$1125 for its use for 1 year 6 months. How much did I make?

II.

1. What is the interest on \$250 for 2 years 6 months at 6% per annum?
2. What is the interest on \$26.25 for 3 years 4 months at 6%?
3. What is the interest on \$1728 for 4 years 9 months at 6%?
4. What is the interest on \$700 for 5 years 6 months 12 days at 6%?
5. What is the interest of \$720 for 1 year 2 months 18 days at 6%?
6. What is the interest on \$2400 for 1 year 9 months 15 days at 6%?
7. Find the amount (interest and principal) at \$1500 for 3 years 3 months 15 days at 6%?
8. Find the interest on \$1200 for 2 years 4 months 18 days at 6%?
9. What is the interest on \$850 for 5 years 7 months 21 days at 6%?
10. Find the amount due on \$900 for 1 year 3 months 6 days at 6%?

III.

Find the *interest* on the following at the rate given.

Principal.	Time to run.	Rate.	Interest required
1. \$240.	1 yr. 4 mo. 12 da.	6%.	
2. \$720.	2 yr. 5 mo. 18 da.	6%.	
3. \$800.	3 yr. 6 mo. 15 da.	6%.	

4. \$197.52	3 yr. 5 mo. 22 da.	6%.
5. \$650.00	3 yr. 10 mo. 21 da.	7%.
6. \$1296.00	8 yr. 10 mo. 15 da.	8%.
7. \$1000.00	2 yr. 4 mo. 9 da.	6%.
8. \$540.00	1 yr. 2 mo. 12 da.	5%.
9. \$2500.00	2 yr. 4 mo. 24 da.	4%.
10. £25.125	2 yr. 6 mo.	6%.

IV.

Find the *amount* of the following at the rates given.

Principal.	Time to run.	Rate.	Amount required.
1. \$2311.50	2 yr. 8 mo. 2 da.	6%.	
2. \$800.00	2 yr. 4 mo. 15 da.	7%.	
3. \$978.18	2 yr. 1 mo. 1 da.	8%.	
4. \$105.38	2 yr. 3 mo. 18 da.	6½%.	
5. \$419.84	1 yr. 11 mo. 18 da.	5%.	
6. \$1700.00	2 yr. 4 mo. 18 da.	4½%.	
7. \$2000.00	1 yr. 3 mo. 12 da.	4%.	
8. \$161.60	2 yr. 9 mo. 3 da.	4½%.	
9. \$3000.00	1 yr. 8 mo. 12 da.	3½%.	
10. \$1200.00	2 yr. 5 mo. 6 da.	4½%.	
11. \$110.43	1 yr. 6 mo. 10 da.	4%.	
12. \$500.00	1 yr. 1 mo. 1 da.	5½%.	
13. \$805.00	7 mo. 6 da.	7%.	
14. \$750.00	3 yr. 3 mo. 3 da.	6%.	
15. \$385.00	2 yr. 5 mo. 3 da.	5%.	
16. \$960.00	2 yr. 3 mo. 15 da.	4½%.	
17. \$450.00	7 mo. 12 da.	5%.	
18. \$790.00	10 mo. 10 da.	10%.	
19. \$205.00	5 yr. 9 da.	6½%.	

20. Find the interest of \$7510.00 from Jan. 5, 1891 to the 10th day of November, 1892 at 6%.

COMMERCIAL PAPER.

A Promissory Note is a written promise to pay some person a specified sum of money on demand, or at a certain time.

The Face of a note is the sum of money promised to be paid. It is written in words in the body of the note and in figures at the top.

The Maker of a note is the party who signs it. The payee is the party to whom it is made payable.

The Holder is the person who owns it. If a note reads "with interest," it draws interest from date, otherwise it draws interest from the time of maturity until paid. When no rate of interest is mentioned the legal rate of the state is taken. Every note should contain the words, "value received," otherwise the owner may be required to prove that value was received.

A Negotiable Note is one that may be transferred from one party to another and must contain the words "to order" or "to bearer." A note payable "to order" becomes negotiable only by the payee writing his name on the back of it—*endorsing* the note. A note payable to bearer is negotiable without endorsement.

The Endorser of a note is the party who writes his name on the back of it. In case of the refusal of the maker to pay the note when due, the endorsers are liable for the whole amount due in the order of signing, unless

each writes above his name the words "without recourse." In most of the states a note becomes *legally* due *three days* after the time specified, unless the words "without grace," are inserted. When days of grace are allowed the note matures on the *last day of grace*. If a note is payable *on demand*, it is legally due when presented. In most states, a note falling due on Sunday, or a legal holiday, must be paid on the day preceding. When the time of a note is stated in months, calendar months are meant. A promissory note dated October 1, for 35 months' time will be legally due January 18.

Legal Interest is the rate fixed by law. Usury is interest at a higher rate than the *legal rate*. In some states a higher rate than that established by law is allowed, if specified in writing. When no rate is specified in notes, etc., the *legal rate* is allowed. A note draws interest from its *maturity* unless it contains the words "with interest." If it contains the words "with interest," interest accrues from the *date* of the note.

Exact Time must be calculated when the time expressed in the note is given in days. In reckoning interest 3 days of grace are to be counted on all notes, in states where days of grace are allowed.

A Protest is a written declaration made by a notary public that the maker of the note has neglected to pay it. It must be made out on the day the note matures, and sent to the endorsers at once to hold them responsible.

The Legislature of the State of New York during its session in 1894 passed an Act abolishing *days of grace*. This law goes into effect Jan. 1, 1895. The note problems in this work, however, have been computed with days of grace.

V.

Find the amount of the following notes when *legally* due.

\$150. FLUSHING, N. Y., JANUARY, 31 1892.

1. Three months after date, for value received, I promise to pay John A. Smith, or order, one hundred and fifty dollars, with interest at six per cent. per annum.

EDWARD M. PECK.

\$500. BELOIT, AUG. 9, 1891.

2. Six months after date, for value received, I promise to pay A. C. Newton, or order, five hundred dollars, with interest at eight per cent.

R. C. LOVE.

\$1200. BROOKLYN, NOV. 22, 1891.

3. Sixty days after date, I promise to pay A. C. Barnes, or bearer, twelve hundred dollars, with interest, valued received.

F. S. IMLAY.

\$200. BUFFALO, DEC. 20, 1891.

4. Thirty days after date, for value received, I promise to pay Eaton, Gibson, & Co., or order, two hundred dollars, with interest.

S. G. CLEVELAND.

\$750. NEW YORK, JAN. 15, 1892.

5. Ninety days after date, we promise to pay Wm. M. Giffin, or order, seven hundred fifty dollars, value received.

A. LOVELL & Co.

\$650. NEW YORK CITY, AUG. 21, 1891.

6. On demand, for value received we promise to pay Jay Gould, or order, six hundred fifty dollars, with interest.

A. C. BARNEY.

LEROY COOLEY.

\$779.25. CHICAGO, ILL., NOV. 15, 1891.

7. Two months after date, we jointly or severally promise to pay John A. Love, or order, seven hundred seventy nine and $\frac{25}{100}$ dollars, with interest, value received.

CARTER HARRISON.

HENRY WOOD.

\$600. PHILADELPHIA, PA., DEC. 14, 1891.

8. Ninety days after date I promise to pay E. B. Owen, or order, at the First National Bank, six hundred dollars with interest, value received.

RICHARD ELY.

\$480. NEWARK, N. J., APRIL, 1. 1892.

9. Three months after date, I promise to pay Claxton & Co., or order, at the Murray Hill National Bank, New York City, four hundred eighty dollars, with interest, value received.

I. H. POLHEMUS.

\$225. BUFFALO, N. Y., OCT. 15, 1892.

10. Two months after date, we promise to pay A. S. Barnes Company, or order, at No. 771 Broadway, New York City, two hundred twenty-five dollars, with interest, value received.

DORAN, DUNCAN & Co.

EXACT INTEREST.

Exact Interest is obtained by reckoning 365 days to the year. It is employed by the U. S. Government, and bankers, and is growing in favor with business men.

ILLUSTRATIVE EXAMPLE.

1. What is the exact interest on \$450 at 10% from May, 25, 1891 to Jan. 8, 1892?

SOLUTION:—From May 25, 1891, to Jan. 8, 1892, there were 228 days. The interest of \$450 for 1 year of 365 days at 10%, is \$45, and for 228 days it is $\frac{228}{365}$ of \$45 which is \$28.11.

OPERATION.

$$\begin{array}{r} \$450. \\ .10 \\ \hline \$45.00 \times 228 \\ \hline 365 \end{array} = \$28.11$$

NOTE:—The exact interest may also be found by deducting from ordinary interest $\frac{1}{3}$ of itself.

2. What is the exact interest on \$140.40 from Aug. 29, 1891, to Nov. 28, 1891, at 6%?

3. What is the interest on a U. S. Treasury note for \$500 from April 1, 1892, to July 15, 1892, at 4%?

4. What is the exact interest at 7%, of \$327.25 from Jan. 15, 1890, to July 12, 1892?

5. A man had \$1200 on interest from May 20, 1886, to Sept. 5, 1891. What was the exact interest at $5\frac{1}{2}\%$?

6. A note of \$250, bearing interest at 6%, was given Oct. 10, 1890. How much *interest* was due Dec. 13, 1891?

7. I loaned a real estate broker \$1500 on his note dated Dec. 1, 1887, to be paid June 13, 1892, at 7 per cent. interest, how much will he have to pay for its *use* during the time?

8. A man went to Minnesota and bought a farm for \$2280, paying \$1200 down, giving his note for the balance, dated August 1, 1891, at 8 per cent. interest. How much will be due June 30, 1892?

9. Geo. A. Love of San Francisco hired on his note, dated November 27, 1889, \$2860, agreeing to pay 9 per cent. for its use. How much was due February 9, 1892?

10. A note for \$293, dated Madison, Wis., April 26, 1889, was paid January 26, 1891. What was the amount at 7% annual interest?

II.

Compute the exact interest and find the amount of the following.

Date.	Principal.	Rate.	When Due.
1. May 10, 1890,	\$450.25,	7½%	Aug. 8, 1891.
2. Sept. 20, 1891,	\$820.10,	6½%	June 5, 1892.
3. Feb. 10, 1891,	\$125.80,	5%	May 11, 1891.
4. Jan. 1, 1889,	\$530.00,	4½%	Nov. 10, 1891.
5. April 7, 1884,	\$1500.00,	5½%	July, 17, 1885.
6. Aug. 13, 1890,	\$705.00,	4%	Nov. 19, 1892.
7. May 1, 1891,	\$1250.00,	6%	Sept. 6, 1892.
8. Aug. 17, 1892,	\$780.00,	10%	Nov. 21, 1892.
9. Jan. 31, 1892,	\$7150.00,	5½%	Sept. 4, 1892.
10. April 15, 1892,	\$1400.00,	8%	Dec. 2, 1892.

BANKING.

The business of banking includes the loaning of money, discounting commercial paper, the issuing of bills, and the transmission of money from one place to another. Wholesale business houses often sell goods *on time*, and take notes in payment for thirty, sixty, or ninety days. These notes are generally discounted at the bank.

When a note is discounted at a bank, the person in whose favor it is made, writes his name on the back,—endorses it. Both he and the maker are then responsible to the bank for its payment. The bank *takes out* the interest in *advance*. This deduction is called **Bank Discount**, and the amount paid over to the endorser is called the *Proceeds* or *Avails*. If a note is drawing interest (which is not usual with this class of notes) then the *bank discount* will be reckoned on the *amount* of the note,—Principal and Interest, at *maturity*.

The greatest difficulty in this and other kindred topics is found in the ignorance of the practical details of business matters. Our text-books are either silent upon these subjects or deal in abstract questions, so that no light is obtainable through the study of them. Teachers should instruct their pupils in practical business as far as they can.

Under this topic the pupil should be led to analyze notes and other commercial paper, and to obtain a knowledge of the forms relating to business and trade.

SUGGESTIVE QUESTIONS.

1. What is a bank? How many kinds?
2. Suppose a bank of issue should fail, would the holders of the notes lose anything? Why?
3. Of what advantage is a bank of deposit?
4. In how many ways may money be deposited in a bank?
5. If a person has deposited money and taken a Certificate of Deposit how can he get the money?
6. Can any one else get it? If so, how?
7. What is a bank pass-book? A check? What use is made of them?
8. Is a note, draft, or check, written with pencil, valid? Can they be dated back?
9. When is Commercial Paper *not* Commercial Paper?
10. What about notes falling due on Sundays or legal holidays?

I.

Date of note and time given to find *maturity*.

1891.	Maturity.	1891.	Maturity.
1. Jan. 5, 3 months.		6. June 16, 4 months.	
2. Jan. 20, 33 days.		7. March 8, 45 days.	
3. Feb. 15, 2 months.		8. July 17, 5 months.	
4. April 1, 60 days.		9. Feb. 28, 30 days.	
5. May 21, 90 days.		10. Sept. 12, 60 days.	

II.

Date of note and time given to find maturity and number of days to run.

1891.	Maturity.	Number of days to Maturity.
1. Mar. 1, 60 days.		
2. May 21, 90 days.		
3. June 2, 1 month.		
4. Jan. 3, 2 months.		
5. Sept. 5, 3 months.		
6. June 1, 6 months.		
7. Mar. 5, 2 months.		
8. Feb. 7, 3 months.		
9. Jan. 5, 3 months.		
10. Feb. 1, 2 months.		

III.

Find the maturity and term of discount.

Date.	Time to Run.	Maturity.	Discounted.	Term.
1. Feb. 5, 1892.	2 months.		Feb. 23, 1892.	
2. June 12, 1891.	6 months.		Nov. 15, 1891.	
3. Dec. 20, 1891.	60 days.		Jan. 22, 1892.	
4. Mar. 15, 1892.	90 days.		May 2, 1892.	
5. Sept. 4, 1891.	3 months.		Oct. 2, 1891.	
6. Sept. 5, 1891.	90 days.		Oct. 5, 1891.	
7. Jan. 4, 1891.	30 days.		Jan. 4, 1891.	
8. Apr. 3, 1892.	60 days.		May 12, 1892.	
9. Oct. 19, 1890.	90 days.		Nov. 21, 1890.	
10. Nov. 5, 1890.	3 mo. 15 days.		Dec. 20, 1890.	

IV.

Find the bank discount of the following:

Date.	Time to Run.	When Dis- counted.	Face.	Rate.	Maturity.
1. Feb. 5, '91.	2 mo.	Feb. 23, '91.	\$850.00	6%	
2. June 12, '90.	6 mo.	Nov. 15, '90.	300.00	7%	
3. Dec. 20, '91.	60 da.	Jan. 22, '92.	175.50	6%	
4. Mar. 15, '89.	90 da.	May 2, '89.	800.00	5%	
5. Sept. 4, '88.	3 mo.	Oct. 2, '88.	750.00	4%	
6. Sept. 5, '90.	90 da.	Date.	550.00	8%	
7. Jan. 4, '92.	30 da.	Jan. 4, '92.	600.00	7%	
8. Apr. 3, '91.	60 da.	May 12, '91.	950.00	6%	
9. Oct. 19, '91.	90 da.	Nov. 21, '91.	1250.00	7%	
10. Nov. 5, '87.	3 mo. 12 da.	Dec. 20, '87.	1500.00	6½%	

V.

Find the bank discount and proceeds of following:

Date.	Time.	Face of note.	When Discounted.	Rate.	Proceeds.
1. Oct. 9, '91.	4 mo.	\$ 960.00	Nov. 11, '91.	9%	
2. Nov. 10, '91.	60 da.	750.00	Nov. 10, '91.	7%	
3. Sept. 29, '90.	90 da.	1200.00	Sept. 29, '90.	5%	
4. Jan. 13, '92.	6 mo.	618.30	Jan. 13, '92.	7%	
5. May 5, '92.	90 da.	1315.75	May 23, '92.	7%	
6. Dec. 20, '90.	2 mo.	375.00	Jan. 21, '91.	10%	
7. Jan. 11, '91.	90 da.	600.00	Feb. 14, '91.	6%	
8. Sept. 1, '90.	90 da.	650.25	Oct. 25, '90.	6%	
9. Jan. 4, '88.	3 mo.	500.00	Mar. 2, '88.	6%	
10. Oct. 31, '89.	90 da.	368.00	Oct. 31, '89.	7%	

VI.

Find the bank discount and proceeds of following:

Date.	Time.	When Discounted.	Face of Note.	Rate.	Proceeds
1. May 10, '92.	3 mo.	June 29, '92.	\$452.50	7%	
2. Sept. 20, '92.	90 da.	Nov. 4, '92.	821.00	6%	
3. Jan. 1, '91.	4 mo.	Jan. 12, '91.	750.00	7%	
4. Jan. 25, '90.	5 mo.	Mar. 15, '90.	625.45	6%	
5. June 12, '92.	60 da.	July 2, '92.	520.16	6%	
6. July 1, '90.	90 da.	Aug. 15, '90.	850.00	5%	
7. Oct. 4, '91.	6 mo.	Dec. 31, '91.	425.00	7%	
8. Jan. 7, '92.	4 mo.	Jan. 18, '92.	225.00	6%	
9. Feb. 13, '91.	6 mo.	May 13, '91.	950.50	5%	
10. Nov. 3, '91.	6 mo.	Jan. 3, '92.	650.75	6%	

VII.

Find Time of Maturity, Term of Discount, Discount and Proceeds of the following notes.

\$900.

CHICAGO, ILL., MAY 8, 1890.

1. Three months after date, for value received, I promise to pay Thomas Hunter or order, nine hundred dollars, at the Marine Bank.

WM. M. HARRISON.

Discounted June 10, 1890 at 8%.

\$850.

BROOKLYN, FEB. 2, 1891.

2. Sixty days after date, I promise to pay to the order of A. C. Allen, eight hundred fifty dollars at the Park National Bank, New York City. Value received.

WM. H. PATTERSON.

Discounted, Feb. 23, 1891, at 6%.

\$1200.

BOSTON, JUNE 6, 1890.

3. Ninety days after date, I promise to pay B. F. Taylor, or order, twelve hundred dollars at the Second National Bank. Value received.

BENJ. F. BUTLER.

Discounted July 5, 1890, at 6%.

\$400.

HACKENSACK, N. J., JAN. 5, 1891.

4. June 10, 1891, for value received, I promise to pay John A. Demarest, or order, four hundred dollars.

NELSON HAAS.

By indorsing this note, Mr. Demarest gets it discounted March 10, 1891, at 6%.

\$600. FLUSHING, N. Y., SEPT. 29, 1890.

5. Sixty days after date, for value received, I promise to pay to Geo. B. Roe & Co., or order, six hundred dollars, at the Flushing Bank.

SAMUEL B. PARSONS.

Discounted Oct. 2, 1890, at 6%.

\$800. GLEN COVE, L. I., SEPT. 5, 1890.

6. Ninety days after date, for value received, I promise to pay Wm. M. Valentine, or order, eight hundred dollars, with interest.

WARD I. FANCHER.

Discounted at 7%, Oct. 5, 1890.

\$750. BUFFALO, N. Y. JULY 16, 1890.

7. Nine months after date, for value received, I promise to pay R. E. Fenton, or order, seven hundred fifty dollars with interest.

JAS. F. BROWN.

Discounted at 6%, Oct. 24, 1890.

\$620. NEW YORK, NOV. 1, 1890.

8. February 23, 1891, for value received, I promise to pay to William Bond, or order, six hundred twenty dollars, with interest.

JOHN F. HENRY.

Discounted at 6%, Dec. 22, 1890.

\$1500. WHITESTONE, L. I., MARCH 14, 1891.

9. Three months from date, for value received, I promise to pay to George Martens, or order, fifteen hundred dollars, with interest at the Flushing Bank.

WM. R. BLEECKER.

Discounted at 6%, March 14, 1891.

\$320.

SAN FRANCISCO, FEB. 5, 1891.

10. Two months after date, for value received, I promise to pay C. H. Martin, or order, three hundred twenty dollars, with interest at 8%.

GEORGE A. LOVE.

Discounted at 10%, at Marine Bank, Feb. 22, 1891.

VIII.

ILLUSTRATIVE EXAMPLES.

I wish to get \$500 from the Nyack National Bank for 60 days, and they are discounting at 6%. How large must I make my note?

ANALYSIS:—

Since the interest on \$1 for 60 + 3 days at 6%, is \$0.0105, the proceeds is \$1.00 — \$0.0105 = \$0.9895, and since \$1.00, face of note gives 0.9895 proceeds, to give \$500 proceeds, the face of the note must be as many times \$1.00 as \$500 is times \$0.9895, or \$505.305, face of note.

OPERATION:—

$$\$500 \div .9895 = \$505.305.$$

1. For what sum must I draw my note in order to obtain \$402 at a bank for thirty days, when they are discounting at 6%?

2. Mr. Graham bought goods to the amount of \$846. For what sum should he make a ninety-day bank note so when discounted at 6% it will give the holder that much cash?

3. I owe a bill of \$444.82 for flour and feed to a firm in Chicago. How large must I draw a sixty-day bank note to pay the bill and cover the discount at 6%?

4. The proceeds of a four-months note, discounted at 6% is \$391.80, what was the face?

5. I want to hire \$1000 from a bank. For what sum must I make a three-months note to obtain that amount, if the bank is discounting at 6%?

6. For what amount must a bank note be made payable in two months, that I may get \$989.50 from a bank, when they are discounting at 6%?

7. I owe James Smith \$484.75. If the bank is discounting at 7%, how large shall I make a six-months bank note that he may get the amount in cash due from me if he has it discounted the same day he receives it?

8. For what sum must a bank note, dated April 15, 1890, and payable October 15, 1890, be drawn to give \$365 when discounted at 6%?

9. Mr. H. B. Niles had a note, without interest, dated June 1, 1890, and *legally* due Aug. 16, 1890. He took it to a bank, endorsed it, and received \$1182.50. If the bank charged 7% discount, for what amount was the note drawn?

10. I have a four-months note, dated July 26, 1892, which I took to a bank Aug. 26, 1892, the bank discounting it at 7%. If I received \$1926.20 in cash as the proceeds, how large was the note?

PARTIAL PAYMENTS, U. S. RULE.

Partial Payments are payments in part, of a promissory note, bond, or similar obligation. When payments are made, the amount and date of each are written as receipts, on the back of the note or obligation.

\$350.

NEW BERLIN, MAY 7, 1888.

1. One year after date, for value received, I promise to pay John A. Munson, or bearer, three hundred fifty dollars with interest at 6% per annum.

FREDERICK BALL.

On this note there were the following indorsements:

Sept. 17, 1890, \$100.

Feb. 11, 1892, 50.

How much was due on the note July 26, 1892?

SOLUTION.

Principal,	\$350.00
Interest from May 7, 1888, to Sept. 17, 1890, 2 yr. 4 mo. 10 da.,	49.58
Amount,	<u>\$399.58</u>
First payment taken out,	100.00
New principal,	<u>\$299.58</u>
Int. from Sept 17, 1890, to Feb. 11, 1892, 1 yr. 4 mo. 24 da.,	25.16
Amount,	<u>\$324.74</u>
Second payment taken out,	50.00
New principal,	<u>\$274.74</u>
Int. from Feb. 11, 1892, to July 26, 1892, 5 mo. 15 da.,	7.56
Amount due July 26, 1892,	<u>\$282.30</u>

Partial Payments, U. S. Rule.—Business Problems. 201

The following is a convenient arrangement of the above example to illustrate the United States Rule.

Yr.	Mo.	Da.	Time.	Principal.	Interest.	Amount.	Payment.	Balance.
1888	5	7						
1890	9	17	2 yr. 4 mo. 10 da.	\$350.	\$49.58	\$399.58	\$100	\$299.58
1891	2	11	1 " 4 " 24 "	299.58	25.16	324.74	50	274.74
1892	7	26	5 " 15 "	274.74	7.56	282.30	none	282.30

\$475.50.

BELOIT, WIS., MAY 1, 1885.

2. For value received, we jointly and severally promise to pay A. S. Barney & Co., or order, four hundred seventy-five dollars fifty cents, nine months after date, with interest at 7%.

JAMES SMITH & Co.

The following indorsements were made on this note:

Dec. 25, 1885, received, \$ 50.

July 10, 1886, " 15.75.

Sept. 1, 1887, " 25.50.

June 14, 1888, " 104.

How much was due April 15, 1889?

OPERATION.

Principal on interest from May 1, 1885,	\$475.50
Interest to Dec. 25, 1885, 7 mo. 24 da.,	21.63
Amount,	\$497.13
Payment Dec. 25, 1885,	50.
Remainder for a new principal,	\$447.13
Interest from Dec. 25, 1885, to July 10, 1886,	\$16.95
" " July 10, 1886, " Sept. 1, 1887,	35.74
" " Sept. 1, 1887, " June 14, 1888,	24.60
	77.29
Amount,	\$524.42
Payment July 10, 1886, less than interest then due,	\$15.75
Payment Sept. 1, 1887,	25.50
Their sum less than interest then due,	\$ 41.25
Payment June 14, 1888,	104.
Their sum exceeds the interest then due,	\$145.25
Remainder for a new principal,	\$379.17
Interest from June 14, 1888, to April 15, 1889, 10 mo. 1 da.,	22.19
Balance due April 15, 1889,	\$401.36

ANALYSIS:—

The interest on the face of the note from its date to the first payment is \$21.63, and as the first payment **EXCEEDS** the interest, we add it to the principal, and subtract the amount paid (\$50), and we have a **NEW** principal, \$447.13. The interest on this new principal (\$447), from the *first* to the *second* payment is \$16.95, which is **GREATER** than the second payment (\$15.75); we therefore find the interest on \$447.13 from the second to the third payment. This interest is \$35.74, and as the two payments do not exceed the interest due at this time we find the interest on the \$447.13 from the third to fourth payment; this interest is \$24.60. As the three payments now **EXCEED** the interest due (\$77.29), we add this interest to the last principal and subtract the sum (\$145.25) of the three payments last made, which gives us a **NEW** principal, \$379.17. The interest on this new principal (\$379.17) from the fourth payment to April 15, 1889, is \$22.19, which being added gives \$401.36.

3. A note of \$500 is dated June 25, 1888, on which there were the following indorsements:

Nov. 19, 1889, \$62.

July 4, 1890, 48.

How much was due on taking up the note Sept. 8, 1891, interest at 6%?

4. A note for \$2,000 was given Jan. 4, 1887, on which were the following indorsements:

Feb. 19, 1888, \$ 400.

June 29, 1889, 1000.

Nov. 14, 1889, 520.

How much remained due on this note Dec. 24, 1890, interest at 6% per annum?

5. A note drawn Sept. 8, 1887, favor C. A. Gould for \$304.84 at 6% interest contained the following indorsements:

Sept. 25, 1888, \$ 60.

July 4, 1889, 90.

Aug. 1, 1890, 10.

Dec. 2, 1890, 100.

What was due Jan. 7, 1892?

6. Find the amount due on a note for \$1,050 given June 7, 1889, at 6% interest on which the following indorsements have been made: .

Oct. 17, 1889, \$250.

Feb. 23, 1890, 100.

Dec. 30, 1890, 50.

July 17, 1891, 225.

This note was paid Oct. 1, 1891.

7. A note of \$350 was dated May 1, 1888, on which were indorsed the following payments:

Dec. 25, 1888, \$ 50.

July 10, 1889, 5.

Sept. 1, 1890, 15.

June 14, 1891, 100.

What was due on taking up the note April 15, 1892, the interest being 6%?

8. A note for \$750, dated Oct. 12, 1890, had two indorsements:

Dec. 27, 1890, \$325.

Aug. 7, 1891, 25.

What was due July 1, 1892 at 7%?

\$756.75.

DEPOSIT, N. Y., JAN. 12, 1888.

9. Three months after date, for value received, I promise to pay C. P. Knapp, or order, seven hundred fifty-six and $\frac{7}{10}$ dollars with interest at 6% per annum.

C. W. STOW.

INDORSEMENTS:—Sept. 18, 1888, \$300.78, Dec. 30, 1889, \$300.50; July 12, 1890, \$6.57; April 24, 1891, \$55.13.

What was due Dec. 30, 1891?

\$896.50.

DELHI, Nov. 13, 1885.

10. On demand, for value received, we jointly and severally promise to pay Wm. H. Patterson, or order, eight hundred ninety-six dollars and fifty cents, with interest at 6% per annum.

GEO. H. MAXWELL.

WM. JACKSON.

INDORSEMENTS:—March 13, 1886, \$100; Dec. 25, 1886, \$25; Sept. 13, 1887, \$55.76; Aug. 7, 1888, \$42.20; Nov. 19, 1889, \$36; Dec. 1, 1890, \$50.75; Jan. 16, 1891, \$347.33; April 22, 1892, \$336.

How much was due on this note Sept. 30, 1892?

MERCHANTS' RULE.

Business men generally settle notes and interest accounts, payable within a year by a specific rule of their own, known as Merchants' Rule. In some states merchants apply this rule to notes for longer periods than 1 year. This interest is generally calculated for the number of days, when the time is less than 1 year.

1. Find the balance due April 15, 1892, on a note of \$250.60, given July 7, 1891, on which the following payments have been made, interest at 7%. Sept. 20, 1891, \$80; Jan. 1, 1892, \$50; March 13, 1892, \$50.

Reckoning time by business methods, exact time without grace, we have for the amount of note July 7, 1891 to April 15, 1892, \$264.39. The amount of \$80, from Sept. 20, 1891, to April 15, 1892, is \$83.24, and the amount of \$50 from Jan. 1, 1892, to April 15, 1892, is \$51.02. The amount from March 13, 1892, to April 15, 1892, is \$50.32.

The sum of the amounts of these payments and interest is \$184.57. Subtracting this from \$264.39 we find \$79.81 to be the balance due.

2. A note of \$500 was given Jan. 1, 1892.

INDORSEMENTS:—Jan 20, 1892, \$100; Feb. 10, 1892, \$50; Feb. 25, 1892, \$100; March 1, 1892, \$150. What was due April 1, 1892, at 6% Bankers' Method in calculating time?

\$400.

BELOIT, WIS., JAN. 1, 1891.

3. One year after date, for value received, I promise to pay N. Doscher, or order, four hundred dollars, with interest at 7%.

A. E. NEWTON.

INDORSEMENTS:—March 16, 1891, \$200; July 1, 1891, \$100. What was due at maturity?

4. A note of \$900, dated Sept. 1, 1891, with the following indorsements: Oct. 18, 1891, \$150; Dec. 22, 1891, \$200; March 15, 1892, \$300. What was due on the note July 19, 1892, interest at 7%?

5. A note of \$720.75 was given March 15, 1892, on which the following payments were made: April 3, \$170; May 20, \$245.30; June 17, \$87.50. How much was due on this note at 6%, Sept. 5, 1892?

COMPOUND INTEREST.

Compound Interest is the interest on the principal and its *unpaid interest* added at stated **periods** according to agreement. It cannot be collected by law in most of the States but is paid by Savings banks to persons who do not draw their interest when it is due. These banks are designed chiefly to accommodate depositors of small sums of money.

1. On Jan. 1, 1890, Harry Olin deposited \$200 in the College Point Savings-Bank. The rules of this bank allow depositors 5% interest on Jan. 1 and July 1, of each year. These rules further state that if the interest is not called for *when due* it shall be added to the principal and draw interest the same as a new deposit. Master Olin left his money in the bank for 3 years. How much was due him at the end of this time?

Principal for the 6 months,	\$200.00
Interest " " "	5.00
New Principal July 1, 1890,	\$205.00
Interest for the 2d six months,	5.12
New Principal Jan. 1, 1891,	\$210.12
Interest for the 3d six months,	5.25
New Principal July 1, 1891,	\$215.37
Interest for the 4th six months,	5.38
(Carry forward)	\$220.75

New Principal Jan. 1, 1892, (<i>Bro't for'd</i>)	\$220.75
Interest for the 5th six months,	5.52
New Principal July 1, 1892,	<u>\$226.27</u>
Interest for the last 6 months period,	5.66
Total on Jan. 1, 1893,	<u>\$231.93</u> Ans.

2. What is the compound interest on \$780 for 2 years 6 months, interest payable semi-annually at 6%?

3. What is the amount of \$200, compound interest, payable annually for 3 yr. 6 mo. 15 da. at 7%?

4. What is the compound interest, and the amount of \$500 for 2 yr. 7 mo. 12 da., interest added semi-annually at 6%?

5. What is the compound interest of \$300 for 4 yr. 8 mo. 12 da. at 8%, semi-annual interest added?

6. Harry Smith borrows \$600 for 1 yr. 8 mo. 24 da., paying simple interest at 6%. He loans it at once to Geo. A. Love, San Francisco, at 7% compound interest semi-annually. How much does he gain?

7. Willard Kelsey deposits \$200 in a savings-bank paying 4% a year payable semi-annually. He withdraws his money after three dividends have been declared. How much money has he, principal and interest?

8. Find the balance due July 1, 1892, on the following savings-bank account of Herbert Hess. Deposits, Jan. 15, 1892, \$175; April 10, 1892, \$60; May 31, 1892, \$110. Checks drawn, March 5, 1892, \$75; May 1, 1892, \$35; June 10, 1892, \$50. Interest at 4% quarterly.

ANALYSIS:—

At the end of March, 1892, the balance due is \$100, which is the *smallest balance* during the *first quarter*; hence the interest

is allowed only on that sum, which is \$1.00. May 2, 1892, the balance due is \$125, which is the *smallest balance* for the *second quarter*; hence the interest is computed on that sum for 3 months and is \$1.25.

Deposits for the six months.

Jan. 15, 1892,	\$175.00
April 10, "	60.00
May 31, "	110.00
Interest on balances,	2.25
	<hr/>
	\$347.25

Drafts for the six months.

March 5, 1892,	\$ 75.00
May 5, "	35.00
June 10, "	50.00
	<hr/>
	\$160.00

Amount due July 1, 1892,	\$187.25
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9. Mary E. Smith deposits in a savings-bank the following sums: Jan. 1, 1891, \$350; Feb. 5, 1891, \$150; March 15, 1891, \$75; May 10, 1891, \$30; June 15, \$100. During the time she has drawn out by check the following sums: Jan. 15, 1891, \$150; Feb. 10, 1891, \$200; March 31, 1892, \$50; June 1, 1891, \$75. How much was due her July 1, 1891, interest added quarterly at 4%?

10. Balance the following account Jan. 1, 1893, for James Brown, who has deposited and drawn as follows: Deposited July 1, 1892, \$275; Aug. 1, 1892, \$125; Sept. 15, 1892, \$57; Oct. 10, 1892, \$350. Checks paid, July 15, 1892, \$100; Sept. 1, 1892, \$150; Nov. 15, 1892, \$68; Dec. 15, 1892, \$125. Interest at 6% on the smallest balance from the first of each quarter.

TAXES.

SUGGESTIONS.

Taxes are sums of money assessed on persons, property, or incomes for the support of government or corporations.

They are laid upon real estate,—land and houses, personal property,—notes, bonds, money, goods, furniture, cattle, etc.

There are various kinds, such as poll, road, dog, and other like taxes. There is a **License Tax**, which permits a person or firm to conduct certain business. There are **Duties** or **Custom Taxes**, which are levied by the *General Government* on goods imported from foreign countries. These duties are of two classes—**Specific**, or a stated price on each article without regard to cost, and **Ad-valorem**, or a certain per cent. on the value of the goods in the country from which they were imported. Some goods are subject to both kinds of duties, as the law may direct.

A **Custom House** is a building where these duties are collected. A **Port of Entry** is a *Seaport* town where a Custom House is situated. Every vessel must carry a *Manifest*, which is a complete *Invoice* of the ship's cargo, with prices and charges for the goods.

I.

1. The assessed valuation of the property of a town is \$2,326,112. The amount required for expenses for the fiscal year is \$11,630.56. What is the rate per cent. of tax on \$1.00, and what is the tax of Smith R. Reid, whose property is assessed at \$8216?

ANALYSIS:—

To find the *rate*, divide the tax to be *raised* by the total taxable property (real and personal), $\$11,630.56 \div 2,326,112 = .005$ rate, or tax on \$1.00.

To find the *percentage*, multiply each person's taxable property by the *rate* of tax and this will give his total tax. Mr. Reid's property is valued at $\$8216 \times .005$ (rate), = \$41.08, R's tax.

NOTE. The person who writes up the "tax-book" usually constructs a table from which he makes out the tax for each person assessed.

2. The assessed value of my house and lot is \$7500, and my personal property \$1500. The rate of taxation is $\frac{1}{4}\%$. Find the whole tax.

3. The valuation of the property in the village of Flushing, both real and personal, according to the assessment roll of 1891 is \$3500000. The whole amount of money to be raised for 1892 is \$42000. What is the rate?

4. If a tax of \$120 is paid on a paint factory valued at \$24000, what is the valuation of a house and lot on which the tax is \$35.00, at the same rate per cent?

5. My house and lot, situated in the village of Nyack, is assessed at \$6750. The assessed valuation of the village is \$2242000, and upon this there is to be levied a tax of \$11210, for building a new school-house. How much is my tax?

6. What is the specific duty on 112 chests of tea, each weighing 67 pounds, tare 12 pounds to the hundred-weight, at \$2 per hundred weight?

ANALYSIS:—

We find the number of hundred-weights in 112 chests of tea to be $(112 \times 67) = 67$ cwt. The tare of 12 lb. to the cwt. on 67 cwt. would be $(67 \times 12) = 8\frac{1}{5}$ cwt., which, subtracted from the gross weight $(67 - 8\frac{1}{5}) = 58\frac{4}{5}$ cwt. On 1 hundred-weight the duty is \$2, and on $58\frac{4}{5}$ cwt. it would be $(\$2 \times 58\frac{4}{5}) = \117.92 .

7. What is the Government tax on 7000 gallons of alcohol at 90 cents?

8. How much will be the duty, at 15% *ad valorem*, on a shipment of books from the United States to Canada, invoiced at \$350?

9. Woolen goods valued at \$2000 U. S. Currency, and weighing 650 pounds, were imported from England to New York. What was the duty at 30 cents per pound, and 20 cents *ad valorem*?

10. How much is the annual tax of Wm. K. Vanderbilt, who is assessed $\frac{1}{2}\%$ on his income of \$350000; $3\frac{1}{2}\%$ on his real estate, valued by the assessor at \$625000, and personal property to the amount of \$800000?

BUILDING AND LOAN ASSOCIATIONS.

Building and Loan Associations are coöperative societies, having for their object the accumulation of a fund from which the members can obtain the means to build or buy houses, on mortgages given by the borrowers.

The members of an association are persons who subscribe for shares. They are of two classes, the *borrowers* and the *non-borrowers*.

The regular instalments *form* the capital of the association, which is loaned to members only. The business is managed directly by the members, and the profits divided equally among them.

Shares are issued periodically in **Series**, each series successively reaching its value and being closed out, and a new series taking its place.

Many associations have only one series. Supposing \$200 to be the value of a share and the *dues* \$1.00 a month, if the capital is accumulated in one hundred months, the non-borrowing member will receive \$200 on a share, and the borrowing member's debt will be cancelled, and his mortgage of \$200 a share will be returned.

The dues in each case have amounted to only \$100, making a profit of \$100, or 100% for the time. In the case of non-payment of dues, fines are imposed.

There are **Three Ways** of loaning the money of these associations.

A **Withdrawal** is made by returning the stock certificates, and making settlements.

These **Ways** of loaning and **Withdrawal** are fully explained in the by-laws of every association.

These associations have been highly successful, in affording means of profitable investments and are promotive of habits of economy and thrift.

Practically they have given homes to thousands who otherwise would never have owned them.

To find the actual cost of stock.

1. What would be the yearly dues on 15 shares of stock at \$1.00 per share for each month?

ANALYSIS:—

Since the dues on 1 share for 1 month are \$1.00, on 15 shares it will be \$15; and for 1 year, or 12 months, 12 times \$15, or \$180.

2. Mr. Taylor buys 10 shares in the First Series, 15 in the Second Series of the Whitestone Building Association. If these series are 9 and 11 years respectively in "closing out," how much money in monthly dues will have been paid in on the two series at the close?

To find the loan, and the total payments of a borrower.

1. I hire money on 20 shares of stock, First Series, and bid 35 cents a month premium. What is my loan and the amount of monthly payments?

ANALYSIS:—

On the instalment plan, the full value of a share is loaned; hence the loan on 1 share is \$200, and on 20 shares it is \$4000.

The interest on \$200 for 1 month at the legal rate, 6%, is \$1.00. This added to the dues and 35 cents premium, gives \$2.35 the monthly payment on 1 share. On 20 shares the payments will be $\$2.35 \times 20$, or \$47.

2. Mr. Williams hires a loan from a building association on 25 shares, at the beginning of the second series, for 45 cents a month premium. What was his loan and what did it cost him if the series runs out in 11 years?

To find cost of a loan to borrower at simple interest.

1. What is the cost of a loan on 10 shares in a new series of a building association, at a premium of 45 cents, interest \$1, dues \$1, as regular monthly payments for $9\frac{1}{2}$ years?

ANALYSIS:—

The monthly payment equals \$2.45 on each share; on 10 shares the payment is \$24.50.

The first instalment is on interest 112 months, the second instalment 111 months, and so on.

The interest of a payment of \$1 for the different periods equals the interest of \$1 for a number of months representing a series. The interest of \$1 for one month at 6% is \$.005, and for the aggregate months, $\frac{1}{2}$ of $112 \times 113 \times \frac{1}{2}$ cents, (No. of mos. \times No. of mos. $+ 1$) or $\frac{112 \times 113}{2}$ cents = \$31.64. On \$24.50 the monthly payment is \$31.64 \times 24.50 = \$759.36; interest at 6%.

The sum of the payments is, \$24.50 \times 112 (No. of mos.), or \$2,724.

The *cost* of the loan equals \$2,724 + \$759.36 or \$3,483.36.

2. Mr. James bought a loan of the Flushing Building Association, on 15 shares of a new series at 40 cents a month premium. What is the actual cost of the loan if the series run out in $8\frac{1}{2}$ years?

PERCENTAGE TEST REVIEW.

I.

1. A coal merchant bought 106 tons 12 hundred-weight of coal, and sold 25% of it to the public school at \$6 per ton. How much did he receive for it ?

2. A milkman buys milk at \$1.60 per can of 40 quarts, and retails it at a profit of 75%. How much does he receive per quart ?

3. A vender bought 4 bu. 2 pk. $2\frac{1}{2}$ qt. of chestnuts at \$3.20 per bushel, and retailed them by the quart, gaining 40%. If he received \$20.51 for them, what was his price per quart ?

4. A grocer buys flour for \$5.88 per barrel, and puts it up into sacks holding $24\frac{1}{2}$ pounds each, which he retails at an advance of $33\frac{1}{3}\%$ on the cost. What is his price per sack ?

5. A merchant bought 10 pieces of muslin, 45 yards each, for \$27, and marked it up 25%. What was his selling price per yard ?

6. Mr. Jackson bought a farm 180 rods long and 160 rods wide for \$6750, and sold it at a gain of 20%. How much did he receive an acre ?

7. A feed-man makes $37\frac{1}{4}\%$ on hay which cost him \$14.40 per ton. What is his profit on 18 tons 15 hundred-weight ?

8. A grocer bought 82 barrels of apples, containing $2\frac{3}{4}$ bushels each, and retailed them at \$1.00 per bushel, making a gain of \$45.10. How much did they cost him?

9. A stationer bought 2 gross of lead-pencils for \$8.64 and retailed them at an advance of $66\frac{2}{3}\%$. What was the selling price per dozen?

10. A dealer bought base-balls listed at \$12 a dozen, for 10% off, and retailed them at $33\frac{1}{3}\%$ advance on cost. How much did he make on the sale of $2\frac{1}{2}$ dozens?

II.

1. A merchant bought 84 yards of Scotch gingham for \$13.44, and sold it at a gain of $12\frac{1}{2}\%$. What did he make on 50 yards?

2. A butcher bought $2\frac{1}{2}$ dozen turkeys for \$36, and had 20% of them stolen. How must the remainder be sold apiece to gain $12\frac{1}{2}\%$ on the lot?

3. A grocer retails pork which cost \$16 a barrel at 25% advance. What is his price per pound?

4. James bought a cart for \$60 and sold it at a gain of 25%. The purchaser sold it at a loss of 20%. What did the latter receive for it?

5. Mr. Conklin's private key for marking goods is "precaution." If he buy gingham at 10 cents a yard, how must he mark them to gain 35 per cent.?

6. What is the cost of sawing a pile of 4-foot wood, 28 feet long and 6 feet high, if $14\frac{2}{3}\%$ of the wood is taken for sawing, and the value of the wood is \$4.00 a cord?

7. The stand-pipe of the Whitestone Water-works is 100 feet high and 20 feet in diameter. If $33\frac{1}{3}\%$ of the amount it holds is used at a fire, how many gallons would that be?

8. A farmer having a bin 16 feet long, 6 feet wide, and 4 feet deep full of wheat, sells $37\frac{1}{2}\%$ of it. How many bushels is that, practical measurement?

9. A man bought copper to line an open tank, which was 10 feet long and six feet square at both ends. The copper was listed at \$1.60 a square foot, from which a discount of 25% was given. How much did he pay for the material?

10. A man owning 165 A. 120 rd. of land, sold 75% of it for \$5670. What was the price per acre?

III.

1. A man paid \$7.50 for coal at \$5 a ton, and gave $33\frac{1}{3}\%$ to a neighbor. What part of a ton did he give away?

2. A woman bought 21 pounds of butter for \$6.30, and used 5lb. 4oz. in a day. What per cent. was that of her purchase?

3. A turnpike 66 feet wide was made through the center of a township. What per cent. of a section of land did it occupy?

4. Willie bought $3\frac{1}{2}$ bushels of chestnuts at \$.45 a peck, and retailed them at 5 cents a pint. What was his per cent. of profit?

5. A milkman bought a 40-quart can of milk at \$.15 a gallon, and sold it for \$2.40. What was his per cent. of profit?

6. A dealer bought 63800 feet of pine lumber at \$27.50 per M., and sold it at 20% advance. What was his gain?

7. Mr. Hunter paid \$47.25 for a pile of 4-foot wood, 56 feet long and 6 feet high, and sold it at an advance of 25%. How much per cord did he receive for it?

8. What per cent. of one dollar is $\frac{1}{4}$ of a dime?

9. A road 4 rods wide was made around a section of land, one-half of which was taken from the adjoining sections. What per cent. of the section did the road occupy?

10. A farmer after building $\frac{3}{4}$ of a mile of fence at a cost of \$.75 a rod, had $37\frac{1}{2}\%$ of it destroyed by fire. What was his loss?

IV.

1. A dealer bought 78600 bricks at \$7.50 per M. and sold them for \$825.30. What was his per cent. of gain?

2. What per cent. does a merchant lose when he sells goods at $\frac{3}{4}$ of their cost?

3. A dealer bought pork at \$18.40 a barrel, and sold it at a loss of 15 per cent. How much did he receive per barrel for it?

4. A bin 12 feet long, 6 feet wide, 4 feet deep is $37\frac{1}{2}\%$ full of oats. How many bushels are in the bin, practical measurement?

5. What per cent. of an acre, is a lot 264 feet long and $49\frac{1}{2}$ feet wide?

6. Lumber sold June 1, at \$12 per M., and the first of October following at \$15 per M. What per cent. had the price advanced, and what was Mr. Clark's gain on 205,600 feet, purchased June 1, 1892?

7. A man bought 7 bu. 3 pk. 4 qt. of nuts at \$4.80 a bushel, and sold them all for \$50.40. What was his gain per cent.?

8. A farmer exchanges 31 lb. 4 oz. of butter worth \$10.20, with his grocer for 204 pounds of sugar, which cost the grocer 4 cents a pound. What was the grocer's gain per cent.?

9. A speculator bought 250 barrels of flour listed at \$4.50 a barrel, with a discount of 10% off for cash. What was his per cent. of gain, if he sold the whole amount for \$1215?

10. The foundation of a house 42 feet long, 25 feet wide, and which is 2 feet above the ground, is $1\frac{1}{2}$ feet thick, extends 4 feet below the surface. What was the expense of building, if the bricks cost \$7.50 per M., and the labor was $12\frac{1}{2}\%$ of the cost of the bricks?

V.

1. There is a gain of $33\frac{1}{3}\%$ on tea when sold at \$1.00 a pound. What would be the gain per cent. if sold at 84 cents a pound?

2. A boy sold a sled for \$1.40, and thereby lost $12\frac{1}{2}\%$. What did the sled cost him?

3. What per cent. is gained by buying syrup at 80 cents a gallon, and selling it at 12 cents a pint?

4. What per cent. is gained by buying coal at the mine for \$3.00 per ton, and retailing it at \$5.00 per ton, the freight and cartage being \$1.50 on each ton?

5. A man bought $\frac{1}{6}$ of a section of land, and sold from it a rectangular lot, 440 yards long and 275 yards wide. What per cent. had he remaining?

6. If a cart is bought at 20% less than \$40, and afterward sold at 25% above cost. What is the selling price?

7. A man sells flour at \$4.80, and gained 14 $\frac{1}{2}$ %. What would have been his gain per cent. had he sold it at 3 cents a pound?

8. If the cost is three-fourths of the selling price, what is the gain per cent.?

9. A shopkeeper marks his goods at 25% above cost, and deducts 12 $\frac{1}{2}$ % of the amount from any customer's bill for cash. What per cent. does he make on cash sales?

10. A merchant bought broadcloth at \$2.40 a yard. At what price must it be marked, that 16 $\frac{2}{3}$ % may be taken off from the marked price, and yet a profit of 33 $\frac{1}{3}$ % be made?

VI.

1. Paid \$4.30 per barrel for flour, and sold for \$5.10. What per cent. was gained?

2. A peddler bought 2 $\frac{1}{2}$ gross of lead-pencils for \$9.00. What per cent. remained after 8 score were sold?

3. A grocer uses a false weight of 15 ounces instead of a pound. What per cent. does he cheat his customers?

4. The expenses of a concert were 25% of the receipts. If the profits were \$150, what were the expenses?

5. I have a rectangular piece of land 160 rods long and 40 rods wide, and a square lot of the same area, around which I built a fence at a cost of \$.50 a rod. What per cent. of the cost of fencing the former is the latter?

6. John spent \$7.80, which was 40% of what he had left. How much had he at first?

7. I paid \$4.50 for coal at \$5.00 per ton. What per cent. of a ton did I buy?

8. A company sold steel rails for \$25 a ton at a profit of 6 per cent., and a total gain of \$240. How many tons were sold?

9. How much water must be mixed with 31 gallons, 1 quart of alcohol, which cost \$45.25, that the mixture may be sold at \$1.25 per gallon, and 25 per cent. gained?

10. By selling a village lot for \$765, I lost 15 per cent. What would I have received for it if I had sold it at a loss of 10 per cent. ?

VII.

1. A farmer sold a horse for \$60, which was \$12 more than $66\frac{2}{3}\%$ of what he cost him. What did he lose on the horse?

2. Four-fifths of a barrel of sugar was sold for what the whole cost. What was the gain per cent.?

3. A grocer paid \$20 for a barrel of mess pork, and retailed $\frac{3}{4}$ of it at 10 cents a pound, and the balance at 12 cents a pound. What was his per cent. of profit?

4. A grocer bought a barrel of vinegar for \$6.30. What must he charge per gallon to make 40% on the whole?

5. A farmer bought a horse, wagon and plow for \$268. The horse cost $1\frac{1}{2}$ as much as the wagon, which cost \$100, and the plow $\frac{1}{2}$ as much as the horse. What per cent. of the price of the horse was the cost of the wagon and plow?

6. A man sold a section of land at \$25.62 $\frac{1}{2}$ an acre, and gained \$1640. What was his per cent. of gain?

7. Five-eighths of a barrel of pork sold for three-fourths of its cost. What was the per cent. of gain?

8. A merchant bought 75 yards of cloth at 25% discount, and sold it at an advance of 20 per cent. from list price, gaining \$45. What was the per cent. gained?

9. A grocer sold flour at \$9.00 a barrel, gaining 25%, but was obliged to sell the remainder of the lot at \$6.48 a barrel. What was his loss per cent. on this?

10. A park 10 rods square, has a walk around it which is $8\frac{1}{4}$ feet wide. What per cent. of the whole area of the park is the walk?

VIII.

1. I sold a piano for \$240, and lost 20%. At what price should I have sold it to gain $12\frac{1}{2}\%$?

2. A shipper bought 820 bushels of potatoes at \$.48 a bushel, and sold the lot for \$492. What was his per cent. of profit?

3. Three-fourths of 160 baskets of peaches, bought at \$1.00 a basket, were sold at an advance of 40%, the balance at a loss of 20%. What was the per cent. of gain on the transactions?

4. For what should pork have been sold per barrel to gain $16\frac{2}{3}\%$, if $33\frac{1}{3}\%$ was lost by selling it at \$16 per barrel?

5. Find the cost per pound of flour, the selling price of which was \$6.86 per barrel, and was sold at a gain of $16\frac{2}{3}$ per cent.

6. What was the cost of silk, sold at \$4.13 a yard at a gain of 18 per cent.?

7. If $\frac{2}{3}$ of a barrel of molasses is sold for what $\frac{1}{3}$ of it cost, what is the loss per cent.?

8. Mr. Knapp sold his horse and carriage for \$420, and thereby cleared 20% on what it cost him. What would he have gained by selling them for \$380?

9. Mr. Mable sold a threshing-machine for \$350, and cleared 20% on this money. What would he have gained per cent. if he had sold for \$70 more than he did?

10. Miss Gibbon sold her pony and cart for \$360, which was $16\frac{2}{3}\%$ more than it cost her. What per cent. would she have made by selling them for $\frac{1}{2}$ more than she received?

IX.

1. What is the increase of a teacher's salary, which, when increased 20% amounts to \$1500?

2. A cloak-maker sold a seal-skin sacque at $16\frac{2}{3}\%$ less than cost, and lost \$25. What did he receive for it?

3. A barrel of vinegar ($31\frac{1}{2}$ gal.) which cost \$7.56, leaked away 25%. At what price per gallon must the remainder be sold that there may be a gain of 10% on the barrel?

4. I sold a harness for \$41.25, and gained 25%. What per cent. would have been lost had I sold it for \$24.75?

5. A grocer sold 20% of a quantity of butter at a gain of 20%, and received \$12. What did the lot cost him?

6. Mr. Jones asked for sugar 20% more than cost, but sold it for 80% of the asking price. What did he lose per cent.?

7. I bought a horse for \$160. What must I ask for him so that 25% of the price may be deducted and still leave a profit of 20 per cent.?

8. Mr. Jenkins sold a horse to Mr. Brice at a gain of $14\frac{1}{2}$ per cent. Mr. Brice sold him to Mr. Gould for \$160, being at a loss to him of 20 per cent. What did the horse cost Mr. Jenkins?

9. A dealer bought flour at \$3.40 a barrel. What must he ask for it that he may deduct $16\frac{2}{3}\%$ from his marked price and still make a profit of $12\frac{1}{2}$ per cent.?

10. A dealer sold 2 horses for \$150 each, or \$300 for the span. On one he made 25%, and on the other he lost 25 per cent. Did he gain or lose and how much?

X.

1. What per cent. of the avoirdupois pound is the Troy pound?

2. Mr. Gruman sold his horse for \$151.20, and lost 10 per cent. on the cost. If he had sold him for \$194.88, what per cent. would he have made?

3. Samuel sold a cart for \$37.50, and lost 25 per cent. What would have been his profit if he had sold it for \$67.50?

4. A farmer sold a horse for \$198, and lost 10 per cent. on what he paid for him. He then bought 3 cows for \$135, and afterward sold them so as to make up the loss on the horse and \$44 besides. What did he receive apiece for the cows?

5. A miller sold 140 bushels of corn for \$175, and thereby gained 25 per cent. How much should he have sold it per bushel to lose 20 per cent.?

6. How much grain must a farmer take to mill, that he may bring home the product of $34\frac{1}{2}$ bushels, after the miller has taken 8% for toll?

7. At what price per keg (100 lb.) must a hardware merchant purchase nails, in order to make 25 per cent. when sold at 3 cents a pound?

8. From what marked price can a hatter fall $\frac{1}{3}$ on hats that cost \$3.20, and still make 20 per cent.?

9. If 80% of the selling price equals the buying price, what is the gain per cent.?

10. A grocer sold pork for \$20 a barrel, of which $33\frac{1}{3}\%$ was gain. What per cent. would he have gained had he sold at 12 cents a pound?

XI.

1. A broker received \$37.50 for selling some railway stock, charging $\frac{1}{3}\%$ brokerage. How many shares did he sell?

2. What would be the net proceeds of a sale of 160 barrels of potatoes at \$1.75 per barrel, allowing $2\frac{1}{2}\%$ commission, and \$6.75 for other charges?

3. What is the retail price of Webster's Dictionary if it cost me \$9.00 after a discount of $33\frac{1}{3}\%$ had been allowed?

4. Mr. Baker bought a bill of books from The American News Company at list prices. The amount of the bill was \$524. What was the net cash value of the books, if they allow a discount of 25% and 5% off for cash?

5. A lawyer collected a note for \$242.50. How much should he pay the owner of the note, his commission being 5%?

6. What is the cost of insuring my furniture, worth \$2500 at 65 cents per \$100, the policy costing \$1.50?

7. If by selling a cow for \$30 I lose 25%, at what price should I have sold her to make \$8?

8. A commission merchant sold a consignment of cotton for \$7240. He paid \$32 for freight and cartage, and charged $2\frac{1}{2}\%$ commission. What was the net proceeds of the sale?

9. I insured my farm buildings for $\frac{3}{4}$ of their value at $\frac{3}{4}\%$ for three years. The premium was \$27. What was their value?

10. A bookseller bought Christmas cards at a discount of 25% and 5%. In making out the bill the clerk gave a discount of 30%, or \$4.50. What should have been the cash price of the cards?

XII.

1. The premium on an insurance of \$3720 is \$23.25. What is the rate per \$100?

2. How many shares of L. I. R. R. stock at 105, brokerage $\frac{1}{8}\%$, can be bought for \$42050?

3. How much N. J. Central R. R. stock at 108, can be purchased for \$64875, brokerage $\frac{1}{8}$ per cent.?

4. Mr. Sewell bought 250 shares of mining stock for \$4,500, and sold 200 shares for what he paid for all. What was his gain per cent.?

5. Moran and Company purchased 40 of the White-stone water-bonds of \$500 each at par, and received in 1893 an annual interest of \$900 on the investment. What was the rate?

6. How much must I invest in N. Y. and New Haven R. R. bonds 8's at 95, to give an annual income of \$3000?

7. How much stock can be bought for \$13585, when the price is $104\frac{1}{4}$, and the brokerage $\frac{1}{8}$ per cent?

8. Which is the better investment, 6% Flushing and College Point R. R. bonds at 84, or 7% L. I. R. R. stock at 105?

9. What must I invest in 6% school bonds at $119\frac{1}{2}$ to secure an annual income of \$1200, brokerage $\frac{1}{4}\%$?

10. When 6% Improvement bonds are selling at $112\frac{1}{2}$, what per cent. interest would the investment yield?

XIII.

1. A broker purchases 110 shares of silver stock, par value \$25 a share, and charges \$6.87 $\frac{1}{2}$ brokerage. What was the rate of brokerage?

2. Mr. Gordon bought 48 shares of railway stock for \$4482. What was the rate of discount?

3. A dealer bought 70 tons of coal for \$315, and sold it at $12\frac{1}{2}\%$ advance. What was his gain per ton?

4. What is the interest on \$760 for 3 years, 4 months, 12 days at 6 per cent.?

5. Find the interest on \$570.05 for 6 years, 10 months, 10 days at $6\frac{1}{2}\%$ per cent.

6. What is the interest on \$480 from June 16, 1892, to Nov. 10, 1892, at 7%, exact number of days?

7. What sum must be invested in New Orleans 6's at 80, to give a yearly income of \$4200?

8. The list price of a lot of gingham is 10 cents a yard. If I buy them at 20% off and sell them at an advance of 25% on the list price, what is my gain per cent.?

9. Find the interest on a 3 months note for \$1800, dated April 15, 1892, at 6%, exact number of days with 3 days grace additional.

10. What is the interest on a note of \$1040, dated Nov. 24, 1892, and due Feb. 10, 1893, at 6%, allowing 3 days of grace?

XIV.

1. A merchant by selling cloth at \$2.50 a yard, gained 25%. What would have been his gain had he sold it at \$3.00 a yard?

2. What is the interest on \$375.25 for 3 years, 8 months, 15 days at 5%?

3. What is the amount of \$240, on interest at 5% for 1 year, 7 months and 15 days?

4. My agent bought 40 carriages for \$150 each, and paid \$25 for storage and \$80 for freight. Allowing $3\frac{1}{2}\%$ commission, what did the carriages cost me?

5. Mr. Niles owns 50 shares of the Manhattan Mercantile Association stock, par value \$100. The company declares an 8% dividend, payable in stock at par. How many shares will he then hold?

6. Mr. Grant gives his note of \$525 dated Oct. 16, 1891, and due March 25, 1892, at 6% interest, and pays it with interest March 28, 1892. How much does he pay?

7. A broker having sold 180 bales of cotton, kept \$108 and sent the planter \$3492. What per cent. commission did he retain?

8. Find the interest on \$594 from Dec. 1, 1887, to June 13, 1892, at 5 per cent.?

9. Find the amount of \$737.64 from May 29, 1878, to June 4, 1892, at 7 per cent.?

10. Mr. Titus having received a 5% dividend from the National Starch Company payable in stock at par, finds that he owns 504 shares (\$100). How many shares had he at first?

XV.

1. An agent bought 1200 sheep at $4\frac{1}{2}\%$ commission. He paid \$25 for care, and \$150 for freight which with his commission, amounted to \$445. What was the price apiece for the sheep?

2. I received \$279 from the silver mine Black Queen as my share of a 9% dividend. How many shares of \$25 each do I own?

3. Mr. Dare sold through his broker 144 shares of Ohio, B. & Q. R. R. stock (100) at $102\frac{3}{4}$, brokerage $\frac{1}{8}\%$. What was the net proceeds?

4. A shipment of wheat was insured at $4\frac{3}{8}\%$ to cover $\frac{1}{4}$ of its value. If the premium was \$122.50, what was the wheat worth?

5. May 10, 1891, Mr. Gould borrowed \$6,840, with which he purchased flour at \$5.70 a barrel. June 22, 1892, he sold the flour for \$6.62 $\frac{1}{2}$ a barrel. How much was his gain reckoning interest at 6 per cent.?

6. If I borrow \$7,500 in New York, and lend it in Wisconsin, paying and receiving the legal rate of interest in each case, how much do I gain in 2 years, 3 months and 3 days?

7. Find the exact interest of \$1570 from July 20, 1892, to Dec. 1, 1892, at 7 per cent.

8. A dealer sold two dozen organs for \$125 each. On one-half of them he gained 25%, and on the other one-half he lost 25%. Did he make or lose, and how much?

9. A grocer sold $62\frac{1}{2}\%$ of a barrel of pork for what the whole barrel cost. If he sold at 12 cents a pound what did he receive for the pork sold?

10. A speculator purchases 450 acres of timber-land at \$27.50 an acre, and borrows the money at 6% to pay for it. At the end of 4 years, 11 months, 24 days he sells $\frac{2}{3}$ of the purchase at \$40 an acre, and the balance at \$45 an acre. If he paid \$450.75 for taxes, how much does he gain?

XVI.

1. A merchant sold a bill of shoes listed at \$240, at a discount of 25% off and 5% for cash. How much cash did he receive?

2. A dealer sold a horse for \$200, and sent the owner \$175. What was his rate of commission?

3. A tradesman marks his hats at \$5 each, but takes off 5% for cash. If his profit is 25%, what did he pay per dozen for his hats?

4. How much above cost must a merchant mark gloves that he may take off 25% from the *marked* price, and still make 25 per cent.?

5. What is the interest on \$2,040, for 5 years, 11 months, 18 days at 7 per cent.?

Find the bank discount and proceeds of the following:

Date.	Time.	When Discounted.	Face of Note.	Rate.
6. April 1, 1892.	60 da.	April 1, 1892.	\$1250.50.	6%.
7. Jan. 12, 1891.	60 da.	Feb. 6, 1891.	520.16.	6%.
8. Mar. 16, 1892.	4 mo.	April 1, 1892.	650.25.	6%.
9. Aug. 20, 1892.	3 mo.	Sept. 7, 1892.	135.50.	6%.
10. April 10, 1892.	90 da.	May 14, 1892.	1200.	7%.

XVII.

1. A man sold a sleigh for \$24 and lost $33\frac{1}{3}\%$. If he had sold at a profit of 25%, how much would he have received for it?

2. What will 42 shares of the Illinois Central R. R. stock cost at $84\frac{1}{2}$, allowing $\frac{1}{8}\%$ for brokerage?

3. If \$59.22 was the premium, and 70 cents the rate on \$100 for three years, what was the amount of insurance?

4. A note of \$65.80, dated Feb. 20, 1890, bearing interest at 7%, was paid June 26, 1892. What was the amount paid?

5. By the banker's method (exact interest), what is the interest on a \$350 note, dated May 11, 1892, and *nominally* due Sept. 10, 1892, at 7 per cent.?

Find the *proceeds* of the following notes:

\$500.

CHICAGO, MARCH 9, 1892.

6. Three months from date I promise to pay to the order of John A. Love, five hundred dollars, value received.

A. FLANAGAN.

Discounted at 8% April 11, 1892.

\$400.

MILWAUKEE, JAN. 12, 1892.

7. Ninety days after date I promise to pay James Carpenter, or order, four hundred dollars, value received.

WM. H. CULLEN.

Discounted at 6% Feb. 1, 1892.

\$625. WALTON, N. Y., AUG. 1, 1892.

8. Sixty days from date, I promise to pay to B. M. Gould, or order, six hundred twenty-five dollars, value received, with interest at 5%.

GEO. A. WEBSTER.

Discounted at 5% Sept. 21, 1892.

\$150. BALTIMORE, MD., JUNE 14, 1892.

9. Four months after date we jointly and severally promise to pay to the order of Charles Gorman, one hundred fifty dollars, value received, with interest at 5%.

JOHN HENDERSON.

JOHN Q. BARLOW.

Discounted at 7% July 20, 1892.

\$650. MEMPHIS, TENN., NOV. 3, 1892.

10. Six months after date I promise to pay to the order of Herman D. Gould, six hundred fifty dollars, value received, with interest at 6%.

JAMES GLADWIN.

Discounted at 7% Jan. 3, 1893.

XVIII.

1. A farmer had 140 sheep; after increasing the number 20%, he sold them all for \$714. How much did he receive apiece for them?

2. How much is a broker's charge for a sale of 95 shares of Kansas Pacific R. R. stock at 106, brokerage being $\frac{1}{2}\%$ on the money invested?

3. A man had his buildings insured for \$12400, for which he paid \$43.40, as premium. What was his rate on the \$100?

4. A debt of \$40.50 was paid May 21, 1892, with interest at 6% from Nov. 9, 1886. What was the amount paid?

5. What is the *exact* interest on a U. S. \$1000 bond at 5%, from Nov. 1, 1890, to April 10, 1891?

\$1000.

COUDERSPORT, PA., JAN. 17, 1892.

6. Ninety days after date, value received, I promise to pay to the order of C. C. Ward, one thousand dollars, with interest at seven per cent.

Discounted at 6% March 2, 1892.

C. A. PECK.

Proceeds required.

7. For what sum must a note be drawn at 90 days, that when discounted at a bank at 6 per cent. the avails will be \$590.70?

8. Find the face of a note payable in 60 days, so that when discounted at a bank at 5 per cent. the proceeds shall be \$1200.

\$2000.

NEW ORLEANS, JAN. 4, 1889.

9—10. On demand, value received, I promise to pay David F. Boyd, or order, two thousand dollars, with interest at six per cent.

F. F. WINCHELL.

Indorsements: Feb. 19, 1890, \$400; June 29, 1891, \$1000; Nov. 14, 1891, \$520. How much remained due Dec. 24, 1892?

XIX.

1. How much ready money will a bank pay on a 90-day note for \$64.50, if they are discounting at five per cent.?

2. Which is the better investment, L. I. R. R. 6's at 102, or Georgia 7's at 120?

3. A merchant marked a lot of cassimeres at an advance of \$.75 on a yard, which gave him a profit of 25%. What was his selling price?

4. I wish to borrow \$500 from a bank. For what sum must I give my note for 30 days, if the bank is discounting at 6 per cent.?

\$500.

KINGSTON, N. Y., JUNE 25, 1888.

5—7. One year after date, I promise to pay Chas. Harding or order, five hundred dollars, with legal interest, value received.

J. NEWTON FIERO.

On this note were the following indorsements:

Nov. 19, 1889, \$92; July 4, 1890, \$48. How much remained due Sept. 8, 1891?

\$600.

JAMESTOWN, N. Y., JULY 12, 1888.

8—10. Six months after date, value received, I promise to pay R. R. Rodgers or order, six hundred dollars, with interest.

SAMUEL G. LOVE.

On this note were the following indorsements: May 24, 1889, \$131.20; Dec. 18, 1890, \$40; Sept. 12, 1891, \$175. How much remained due July 12, 1892?

XX.

1. A merchant bought 40 barrels of flour and sold $62\frac{1}{2}\%$ of it at \$9 a barrel, gaining 25%. Afterward he sold the balance at \$6.48 a barrel. What per cent. did he gain?

2. A commission merchant charged \$34.56 for selling 320 barrels of potatoes at \$2.40 a barrel. What was his rate per cent.?

3. My annual income is \$2800 from 4% water-bonds. How many bonds of \$500 each do I hold?

\$750. WHITESTONE, L. I., JUNE 16, 1892.

4. Nine months after date, value received, I promise to pay John M. Clark or order, seven hundred fifty dollars, with interest at six per cent.

Discounted at 6% Oct. 24, 1892. FREDERICK COOK.

Proceeds required.

5. For what sum must I make my note in order to get \$393.80 at a bank for 90 days if the bank is discounting at 6%?

\$650. BATAVIA, N. Y., JAN. 1, 1892.

6. On demand, value received, I promise to pay to the order of Samuel Beckwith, six hundred fifty dollars, with interest at six per cent.

JOHN KENNEDY.

Indorsements: June 10, 1892, \$125; Sept. 30, 1892, \$75.50; Oct. 3, 1892, \$210.

What was the amount due Dec. 31, 1892, Merchants' Rule?

7. What is the compound interest on \$450 for 2 years 6 months at 7%, payable semi-annually?

8. What is the compound interest of \$500 for 2 years 7 months 9 days at 6%?

9. If a tax of \$5097 is levied on a village the taxable property of which is assessed at \$849,500, what is Mr. Smith's tax whose property is assessed \$3570?

10. What is the duty at 20%, on 55 chests of tea, each containing 67 pounds, and invoiced at 45 cents a pound, the tare being 9 pounds a chest?

RATIO AND PROPORTION.

The quotient of 12 divided by three is 4.

A *Ratio* is the relation of two numbers expressed by their quotient.

The ratio of 12 to 3 is expressed in this way, 12 : 3. It is read, "The ratio of 12 to 3."

The *Terms* of a ratio are the numbers compared.

The *Antecedent* is the first term of the ratio.

The *Consequent* is the second term of the ratio.

The two terms of the ratio are called a *Couplet*.

NOTE. Terms of a ratio must be expressed in the same denomination.

In each of the following couplets name the antecedent, and the consequent, and determine the ratio :

- | | | |
|-------------|--------------------------------|----------------------------|
| 1. 12 : 4. | $\frac{1}{3} : \frac{3}{4}$. | \$.24 : \$.06. |
| 2. 4 : 12. | $\frac{7}{8} : \frac{5}{8}$. | 13 yd. : 6 yd. |
| 3. 16 : 8. | $\frac{3}{4} : \frac{3}{7}$. | 4½ lb. : $\frac{7}{8}$ lb. |
| 4. 17 : 24. | $\frac{1}{8} : \frac{1}{25}$. | 3.3 mi. : 33 mi. |
| 5. 3 : 9. | $\frac{8}{9} : \frac{3}{4}$. | 16 men : 256 men. |

A *Simple Ratio* has but one antecedent and one consequent. All of the ratios expressed above are simple ratios.

The ratio of 6 to 12 is $\frac{1}{2}$. The ratio of 3 to 4 is $\frac{3}{4}$. The product of these simple ratios is $\frac{3}{8}$.

A *Compound Ratio* is the product of two or more simple ratios.

We express the compound ratio, indicated above, as follows :

$6 : 12$ } We read it, "The compound ratio of 6 to 12 and
 $3 : 4$ } 3 to 4."

a. *The value of a compound ratio may be expressed by dividing the product of the antecedents by the product of the consequents.*

Find the values of the following compound ratios :

1. $\left\{ \begin{array}{l} 3 : 7 \\ 5 : 9 \end{array} \right\}$ 2. $\left\{ \begin{array}{l} 9 : 1 \\ 6 : 7 \end{array} \right\}$ 3. $\left\{ \begin{array}{l} 7 \text{ yd.} : 5 \text{ yd.} \\ \$3 : \$2 \end{array} \right\}$ 4. $\left\{ \begin{array}{l} \$6 : \$10 \\ 3 \text{ men} : 5 \text{ men.} \end{array} \right\}$

Ratios may be equal. The ratio of 4 to 8 is equal to the ratio of 50 to 100.

An equality of ratios is a *Proportion*.

The equality of the above ratios is expressed, $4 : 8 = 50 : 100$, or $4 : 8 :: 50 : 100$; and is read, "4 is to 8 as 50 is to 100."

The first and fourth terms of a proportion are called the *Extremes*. The second and third terms of a proportion are called the *Means*.

b. *The product of the means is equal to the product of the extremes.*

c. *If the product of the extremes be divided by a given mean the quotient will be the other mean.*

d. *If the product of the means be divided by a given extreme the quotient will be the other extreme.*

Find the missing terms in the following proportions :

1. $\$70 : \$40 :: () : \$10$. 3. $80 \text{ yd.} : 800 \text{ yd.} :: \$40 : ()$.
 2. $() : 17 \text{ bu.} :: \$27.50 : \5.50. 4. $300 \text{ men} : () :: 50 \text{ bbl.} : 30 \text{ bbl.}$

ANALYSIS AND PROPORTION.

ILLUSTRATIVE EXAMPLE.

If 9 yards of cloth cost \$45, what will 36 yards cost ?

Solution by Analysis.

If 9 yards cost \$45, 1 yard will cost \$5, and 36 yards will cost 36 times \$5, or \$180.

Solution by Proportion.

A ratio exists between 9 yards and 36 yards, and an equal ratio exists between the cost of 9 yards and the cost of 36 yards. Since there is an equality of ratios we may establish the following proportion : 9 yards : 36 yards :: \$45 : (). Finding the missing extreme we determine the cost of 36 yards to be \$180.

NOTE. To solve a problem by proportion let the missing quantity stand as the fourth term of the proportion, and the given related terms stand as the first couplet, being careful that the order of their arrangement agrees with the conditions of the problem.

Solve the following problems both by analysis and by proportion :

1. If 25 horses cost \$3125, what will 72 horses cost ?
2. To pave an area of 3200 square feet, \$72 are paid. Find the cost of paving an area of 3200 square yards.
3. A railway company paid \$483000 for the construction of 23 miles of its road through the mountains. At this rate how many miles could be built for \$1000000 ?
4. If a pole 60 feet long cast a shadow of 37 feet, how long a shadow will a pole 72 feet high cast at the same time of day ?

5. The interest on \$800 for a certain time is \$96. What principal will produce \$36 in the same time and at the same rate?

6. A man travels 360 miles in 12 days. At the same rate per day how far will he travel in 21 days?

7. Fanning has \$2991. Munson's money is to Fanning's as 9 to 7. How much money has Munson?

8. What number compared with 984, shows the same ratio as 17 compared with 123?

9. 48 men receive for 23 days' labor a certain sum of money. How many days should 58 men labor to receive the same sum?

10. Food enough was in store to last a garrison of 6000 men 3 months. How many must leave that the food may last the remainder of the garrison 9 months?

COMPOUND PROPORTION.

A *Compound Proportion* is one in which one of the ratios is compound.

ILLUSTRATIVE EXAMPLE.

If 5 men dig 80 rods of ditch in a day of 8 hours, how many rods will 15 men dig in a day of 6 hours?

Solution by Analysis.

If 5 men dig 80 rods in 8 hours, 5 men will dig 10 rods in 1 hour, and 1 man will dig 2 rods in 1 hour. 15 men will dig 30 rods in 1 hour, and in 6 hours 15 men will dig 180 rods.

Solution by Proportion.

If the 5 men worked the same number of hours as the 15 men, the ratio of the second couplet would be as 5:15. Since the 5 men work $\frac{1}{3}$ as long as the 15 men the ratio of the second couplet must be $\frac{1}{3}$ of the ratio of 5 to 15, else a true proportion could not exist.

The proportion would stand :

$$\begin{matrix} 5 : 15 \\ 8 : 6 \end{matrix} \} :: 80 : (?)$$

Written Work : $\frac{80 \times 15 \times 6}{5 \times 8} = 180.$

NOTE. In arranging the related numbers in the forming of the compound proportion it is well to let the term which is of the same denomination as the missing term stand as the antecedent of the last couplet. In arranging the related numbers into sets to form the separate couplets of the compound ratio, arrange each couplet as if the finding of the missing term depended on that couplet alone.

Solve the following problems both by analysis and proportion :

1. If it cost \$40 to build a fence 16 rods long and 5 feet high, how much will it cost to build a fence 25 rods in length and 4 feet high?

2. 12 men in 15 days can dig a cellar 40 feet long and 27 feet wide. How many men will it take to dig a cellar of the same depth 36 feet long and 15 feet wide in 10 days?

3. 5 horses in 12 days consume 20 bushels of oats. 9 horses in 16 days will consume how many bushels?

4. If it take 40 tons of coal to run 5 fires 12 days of 8 hours each, how many tons will be required to run 7 fires 30 days of 10 hours each?

5. \$600 gain \$72 interest in 2 years. In how many years at the same rate will \$92 gain \$54?

6. The cost of boarding an area 960 feet long and 84 feet wide, was \$872. What was the cost of boarding an area 32 by 21 feet with the same kind of material?

7. 7 men can husk 1400 bushels of corn in 10 days. How many men will it take to husk 3000 bushels in 5 days?

8. 30 shoemakers complete 600 pairs of shoes in 15 days. 7 shoemakers will complete 90 pairs in how many days?

9. If 8 men, working 5 days of 10 hours each, mow 40 acres of grass, how many acres will 6 men mow in 7 days of 9 hours each?

10. One number of years is to another number of years as 7 is to 12; one principal is to another principal as 23 is to 24; one rate is to another rate as $1\frac{1}{2}$ is to 2. If the longer time, the larger principal, and the higher rate produce an interest of \$90, what interest will be produced by the other principal, time, and rate?

PARTNERSHIP.

An association of two or more persons for the transaction of business is called a *Partnership*.

A and B agreed to do business together for a term of years. A invested \$3000 and B \$5000. They agreed to share all gains and losses in proportion to the capital invested by each.

At the end of the first year it was found that the net gain of the business transacted by A and B was \$2400.

As A had invested $\frac{3000}{8000}$ of the whole amount of the capital, or $\frac{3}{8}$ of it, he should receive $\frac{3}{8}$ of the gain, or \$900. B, having invested $\frac{5}{8}$ of the capital, should receive $\frac{5}{8}$ of the gain, or \$1500.

NOTE. Examples of this kind may be solved by proportion as well as by analysis. The statement of the above example by proportion would stand:

$$\$8000 : \$3000 :: \$2400 : \text{A's Gain.}$$

$$\$8000 : \$5000 :: \$2400 : \text{B's Gain.}$$

Solve the following problems both by analysis and proportion:

1. A pasture was hired for the season by 3 men, A, B, and C. They agreed to pay \$84 for its use. A pastured 3 cows for the season, B 4 cows, and C 5 cows. What part of the \$84 should each pay?

2. In a partnership A put in \$600, B \$900, and C \$200. What proportion of a loss of \$1800 should each sustain?

3. Divide \$4800 among three persons so that their shares shall be in the proportion of 7, 8, and 9.

4. Smith owed three creditors \$400, \$600, and \$800, respectively. His debts amounted to \$2300 and his assets to \$5900. What did each of the three creditors above receive?

5. Apportion a loss of \$2800 among three partners whose capital invested was in the proportion of 1, 4, and 5.

6. The stock of a store damaged by fire and water to the extent of \$8000, was insured in three companies for \$2000, \$4000, and \$15000, respectively. How much of the loss was sustained by each company?

7. A's capital is \$8000. B's equals $\frac{1}{4}$ of A's. C's is $\frac{3}{4}$ times B's. D's is equal to the sum of all the others. What part of a gain of \$10000 should each receive?

8. In a co-operative association M furnishes 30 men for 2 days, N 20 men for 10 days, and O 16 men for 9 days. \$1200 is paid for the work done. Of this sum how much did M, N, and O each receive?

9. A building and its contents valued at \$72000, was destroyed by a cyclone. A owned $\frac{1}{4}$ of it, B $\frac{3}{8}$ of it, and C the rest. What loss did each sustain?

10. A man failing in business paid 50 cents on the dollar. With assets of \$40000, how much would X, Y, and Z receive whose claims against him were respectively \$2000, \$3000, and \$4000?

POWERS AND ROOTS.

FINDING POWERS, OR INVOLUTION.

$$2 \times 2 = 4.$$

$$3 \times 3 \times 3 = 27.$$

$$4 \times 4 \times 4 \times 4 = 256.$$

4, 27, and 256 are products of equal factors. Such products are called *Powers*.

The product of *two* equal factors is the *second power*, or *square* of a number. The product of *three* equal factors is the *third power*, or *cube* of a number. The product of *four* equal factors is the *fourth power* of a number. In general, the power derives its name from the number of times a factor is used in forming that power.

The process of finding powers is called *Involution*.

The fifth power of 7 is indicated in this way, 7^5 ; and the expression is read, "The fifth power of 7."

The small figure above and to the right of the number, indicating the number of times the factor is used in making the power, is called the *Index*, or *Exponent*.

1. What is the square of 7? of 9? of 12? of $\frac{1}{2}$? of .25?
2. What is the cube of $\frac{1}{2}$? of $\frac{1}{3}$? of 1? of 2? of 3? of 4? of 5?
3. Raise the following numbers to the power indicated by their exponents: 2^8 ; 3^8 ; 11^2 ; 1.2^2 ; $(\frac{1}{8})^2$; $(\frac{1}{8})^8$.
4. What is the area of a square 13 inches on a side?
5. Find the cubical contents of a block of stone 8 feet long, and as wide and high as long.

6. Find and memorize the squares of the numbers from 1 to 25, inclusive.

7. Fill out the missing parts of the following equations :
 $33^2 = \quad . \quad (\frac{7}{8})^2 = \quad . \quad (15\frac{1}{2})^2 = \quad . \quad .99^2 = \quad . \quad 100^2 = \quad .$

8. What is the sum of the 5th power of $\frac{1}{2}$ and the square of $\frac{1}{2}$?

9. Find the product of the second power and the third power of any number you may select. Compare this product with the fifth power of the same number. What do you find true in this case?

10. Build a right-angled triangle with short side of 3 inches, long side of 5 inches, and the other side of 4 inches. Construct a square on each of the sides of the triangle. Find the areas of these squares. Compare the area of the square built on the long side with the sum of the areas of the squares built on the two shorter sides. State what you find to be true? Try this with a "6, 8, 10" triangle.

FINDING ROOTS, OR EVOLUTION.

$$4 = 2 \times 2.$$

$$27 = 3 \times 3 \times 3.$$

$$256 = 4 \times 4 \times 4 \times 4.$$

We have learned to call 4, 27, and 256 powers.

One of the *two* equal factors which produce the power 4 is 2. One of the *three* equal factors which produce the power 27 is 3. One of the *four* equal factors which produce the power 256 is 4.

One of the equal factors which produce a power is called a *Root* of that power.

One of *two* equal factors of a power is called the *second*, or *square* root of that power. One of the *three* equal factors producing a power is called the *third*, or *cube* root of that

power. One of the *four* equal factors of a power is called the *fourth* root of that power. In general, the root derives its name from the number indicating the number of times it is used in forming a power.

The process of finding roots of powers is called *Evolution*.

The second or square root of 9 is indicated thus, $\sqrt{9}$; and is read, "The square root of 9." The third or cube root of 64 is indicated in this way, $\sqrt[3]{64}$; and is read, "The cube root of 64." The fifth root of 243, $\sqrt[5]{243}$, is read, "The fifth root of 243."

$\sqrt{}$ is called the *Radical* sign. The small figure above the radical sign, indicating what root of the number under the radical is to be taken, is called the *Index* of the root.

If the radical sign is used without an index, the square root is indicated.

1. What is the square root of 1? 4? 9? 16? 25? 36? 49? 64? 81? 100?

2. Of what number is 11 the square root? 20? 40? $\frac{1}{2}$? $\frac{4}{9}$? $\frac{1}{3}$? 13?

3. Find the value of the following: $\sqrt{36}$; $\sqrt{81}$; $\sqrt{1}$; $\sqrt{1}$; $\sqrt{1.44}$; $\sqrt{64}$; $\sqrt{2\frac{1}{4}}$.

4. What is the side length of a square having an area of 900 square yards? Of one having an area of 10000 square rods?

5. An oblong, nine times as long as wide, has an area of 441 square feet. What are its dimensions?

HOW TO FIND THE NUMBER OF FIGURES IN THE SQUARE ROOT OF ANY GIVEN NUMBER.

Up to the present time we have been able to find required roots by inspection. We often desire to find roots of num-

bers that we cannot readily determine in this way. 2116 is a perfect square, but an inspection does not readily prove to us that its square root is 46.

$$1^2 = 1. \quad 10^2 = 100. \quad 100^2 = 10000.$$

$$9^2 = 81. \quad 99^2 = 9801. \quad 999^2 = 998001.$$

It will be seen from an observation of the table above that the square of a one order number is a one or two order number; the square of a two order number is a three or four order number; and that the square of a three order number is a five or six order number.

In general, we find that the square of any number contains twice as many orders as the number itself, or one less than twice as many.

It will be seen from this fact that if we separate a number into periods of two orders each, beginning with units, that the number of such periods found in the number will indicate the number of orders found in its square root.

THE PARTS THAT GO TO MAKE UP A POWER.

If we build a second power and observe of what we construct it, as well as in what parts of the power the different combinations appear, it will aid us not a little when we come to take out these parts in the finding of the square root, for what we put in when making the power we must take out in finding the root, and in the reverse order.

Let us raise 46 to the second power :

$$\begin{array}{rcl}
 46 = & 40 + 6 = & 40 + 6. \\
 \underline{46 =} & \underline{40 + 6 =} & \underline{40 + 6.} \\
 276 = & 240 + 36 = & (40 \times 6) + 6^2. \\
 \underline{184 = 1600 + 240} & = 40^2 + & (40 \times 6) \\
 2116 = 1600 + 480 + 36 = & 40^2 + 2 \times (40 \times 6) + 6^2.
 \end{array}$$

An inspection of the partial and final products above will

show you that the second power of this number contains three elements :

1. The square of the units.
2. Twice the product of the tens by the units.
3. The square of the tens.

What is true of the number 46 is true of all numbers. Hence we have the following formula :

"The square of a number = tens² + 2 × (tens × units) + units²; or, more briefly: "The square of a number = $t^2 + 2(t \times u) + u^2$."

ILLUSTRATIVE EXAMPLE.

What is the square root of 2116?

Written Work.

$$\begin{array}{r}
 2116(46 \\
 t^2 = 16 \\
 2 \times 4t = 8t \quad 51 \\
 6 \times 8t = 48 \\
 \hline
 36 \\
 u^2 = 36
 \end{array}$$

Analysis.

Separating the number into periods of two figures each, beginning with units, we find that the required root contains two figures, tens and units.

The highest orders of the power contain the square of the

tens of the root. The greatest square to be found in 21 (hundreds) is 16 (hundreds). The square root of 1600 is 4 (tens). This 4 we write as the tens of the root, or first found figure of the root. Taking the square of the 4 (tens) or 16 (hundreds) from the 21 (hundreds) of the power we have remaining 5 (hundreds).

The second part of the power is composed of *twice the tens times the units*, and is thus *tens*. We unite the 1 ten of the power with the 5 (hundreds) remaining, making 51 (tens).

In this 51 tens is a product made up of *twice the tens of the root times the units of the root*. To find the units of the root we divide the 51 tens by twice the 4 tens, (8 tens), and obtain the 6 (units) which we place as units of the root.

Taking away 48 (tens), 6×8 tens, from 51 (tens) we have 3 (tens) remaining.

That part of the power now left, 3 (tens) and 6 (units), or 36 units, contains the square of the units of the root. The square of 6 units taken from 36 units leaves a remainder of nothing.

ILLUSTRATIVE EXAMPLE.

What is the square root of 748.0225 ?

Abbreviated Written Work.

$$\begin{array}{r}
 748.0225(27.35 \\
 2^2 = \underline{4} \\
 2 \times 2 = 4)34 \\
 4 \times 7 = \underline{28} \\
 68 \\
 7^2 = \underline{49} \\
 2 \times 27 = 54)19.0 \\
 .3 \times 54 = \underline{16.2} \\
 2.82 \\
 .3^2 = \underline{.09} \\
 2 \times 27.3 = 54.6)2.732 \\
 .05 \times 54.6 = \underline{2.730} \\
 .0025 \\
 .05^2 = \underline{.0025}
 \end{array}$$

Analysis.

We have here to extract the square root of a number consisting of an integral number and a decimal.

We separate the integral part of the number into periods, as in the previous illustration, and beginning with hundredths point off the decimal part to the right and in the same way.

Having determined the integral part of the root in the same way as before learned, we consider it to be tens with reference to the next order sought, double it

for a new divisor and use it as a divisor for a new dividend as before.

As we proceed we always consider the part of the root already found as tens of the next order of the root that we are searching for.

RULE FOR EXTRACTING THE SQUARE ROOT.

1. Separate the number into periods of two orders each, beginning with units' order.
2. Find the highest square in the left hand period, and use its square root as the first or highest order of the root.
3. Square the order of the root already found, subtract this square from the part of the power used, and to the remainder annex the next period of the power for a dividend.
4. Double the order of the root now found for a trial divisor and divide the dividend, exclusive of its right hand order, by this divisor. The quotient (or the quotient diminished by 1) will be the next order of the root. (Note 1.)

5. *Annex the second order of the root to the trial divisor, and multiply this by the last found order of the root, subtracting the product thus obtained from the dividend. (Note 2.)*

6. *Annex to this remainder the next period of the power for a new dividend, and divide it, exclusive of the right hand order, by double the part of the root already found. Continue as before until all the periods of the power have been used.*

Note 1. When the divisor is not contained in the dividend, place a cipher as the next order of the root, and a cipher at the right of the trial divisor, increasing at the same time the dividend by annexing the next period of the power.

Note 2. If this product is greater than the dividend, decrease the second term of the root by one and find a product that is less than the dividend.

Note 3. If the number is not a perfect square, annex periods of ciphers as required and carry the result to three or more decimal places.

Note 4. The square root of a fraction may be obtained by taking the required root of both numerator and denominator, or by changing the fraction to the decimal form and then finding the root.

1. Extract the square root of each of the following squares :
1296 ; 3136 ; 6084 ; 18225 ; 105625 ; 8779.69.

2. Find the dimensions of a cubical box the area of its faces being 23064 square inches.

3. A rectangle is 392 feet by 128 feet. What is the length of one side of a square having the same area ?

4. What is the length in rods of the side of a square field containing $35\frac{1}{2}$ acres ?

5. Find the distance around a square 10 acre field.

6. I exchanged two plots of ground 16 by 18 rods, and 8 by 92 rods, respectively, for a square plot equal in area to the two rectangular plots. What was the length of one side of the square plot ?

7. A stone mason was paid \$88.20 for dressing the faces of a cubical stone, at 30 cents per square foot. What were the dimensions of the stone ?

8. Find the difference in the cost of fencing a field 36 by 169 rods and a field of the same area in the form of a square, if the fencing cost \$1.37½ per rod.

9. 2232 men were arranged in the form of the largest square possible, with rank and file of the same number. Twenty-three men were left over. How many men in each rank or file?

10. Five boards, each 9 feet long and 9 inches wide, were made into a square table without waste of material. Give the dimensions of the table in feet and hundredths of a foot.

**HOW WE MAY DETERMINE THE NUMBER OF ORDERS IN THE
CUBE ROOT OF A GIVEN NUMBER.**

$1^3 = 1$	$10^3 = 1000$	$100^3 = 1000000$
$4^3 = 64$	$44^3 = 85184$	$444^3 = 87528384$
$9^3 = 729$	$99^3 = 970299$	$999^3 = 997002999$

It will be seen from an inspection of the above table that the cube of a one order number is a one, two, or three order number: the cube of a two order number is a four, five, or six order number; and the cube of a three order number has seven, eight, or nine orders in its cube.

In general, we find that the cube of any number contains three times as many orders as the number itself, or one or two less than three times as many.

If, then, a number be separated into periods of three orders each, beginning with units order, the number of such periods found will indicate the number of orders in the cube root of that number.

THE PARTS THAT GO TO MAKE UP A THIRD POWER.

We built a second power and determined its composition.

If we multiply the second power of 46 by 46, we shall have the third power, or cube of 46 ; ($46^2 \times 46 = 46^3$).

Let us take the products that we found in the square of 46, multiply each of these products by 46, thus obtaining the cube of 46, and see what combinations appear in the cube that did not appear in the square.

The small letters in each of the examples following indicate the same quantity, though this quantity appears in different forms as it illustrates the partial and final products found in the cube of a number.

A.

2116 = The square of 46.

$$\begin{array}{r} 46 \text{ (a)} \\ 12696 \text{ (b)} \\ 8464 \text{ (c)} \\ 97336 \text{ (d) = The cube of 46.} \end{array}$$

B.

1600 + 480 + 36 = The square of 46.

$$\begin{array}{r} 40 + 6 \text{ (a)} \\ 9600 + 2880 + 216 \text{ (b)} \\ 64000 + 19200 + 1440 \text{ (c)} \\ 64000 + 28800 + 4320 + 216 \text{ (d) = The cube of 46.} \end{array}$$

C.

$40^2 + 2 \times (40 \times 6) + 6^2 =$ The square of 46.

$$\begin{array}{r} 40 + 6 \text{ (a)} \\ (40^2 \times 6) + 2 \times (40 \times 6^2) + 6^3 \text{ (b)} \\ 40^3 + 2 \times (40^2 \times 6) + (40 \times 6^2) \text{ (c)} \\ 40^3 + 3 \times (40^2 \times 6) + 3 \times (40 \times 6^2) + 6^3 \text{ (d) = The cube of 46.} \end{array}$$

D.

$\text{Tens}^2 + 2 \times (\text{Tens} \times \text{Units}) + \text{Units}^2 = 46^2$

$$\begin{array}{r} \text{Tens} + \text{Units} \text{ (a)} \\ (\text{Tens}^2 \times \text{Units}) + 2 \times (\text{Tens} \times \text{Units}^2) + \text{Units}^3 \text{ (b)} \\ \text{Tens}^3 + 2 \times (\text{Tens}^2 \times \text{Units}) + (\text{Tens} \times \text{Units}^2) \text{ (c)} \\ \text{Tens}^3 + 3 \times (\text{Tens}^2 \times \text{Units}) + 3 \times (\text{Tens} \times \text{Units}^2) + \text{Units}^3 \text{ (d) } = 46^3 \end{array}$$

We see from an inspection of these partial and final prod-

ucts that the cube of a number is made up of the following elements :

1. The cube of the units.
2. Three times the tens times the square of the units.
3. Three times the square of the tens times the units.
4. The cube of the tens.

If we take out of a third power the combinations that were put together to make it we may readily determine its cube root.

Let us apply the knowledge we have gained in the extraction of the cube root of a given number.

Formula: "The cube of a number = $t^3 + 3(t^2 \times u) + 3(t \times u^2) + u^3$."

ILLUSTRATIVE EXAMPLE.

What is the cube root of 157464?

Written Work.

$$\begin{array}{r}
 157464 \text{ (54.} \\
 t^3 = \underline{125000} \\
 3 \times t^2 = 75 \overline{)32464} \\
 3 \times u \times t^2 = \underline{30000} \\
 \quad \quad \quad 2464 \\
 3 \times t \times u^2 = \underline{2400} \\
 \quad \quad \quad 64 \\
 u^3 = \underline{64}
 \end{array}$$

Analysis.

By separating the number into periods of three figures each we find that its cube root is a two order number, consisting of tens and units.

We know what we put in to form the power, and we will proceed to take these parts out in a reverse order.

As the first part of the power contains the cube of the tens of the root, we find the greatest cube in 157 (thousands). This we see is 125 (thousands). The cube root of 125 (thousands) is 5 (tens). The 5 (tens) we place as the tens of the root. Taking away 125 (thousands) from the power we have remaining 32 (thousands), 46 (tens), and 4 (units).

In this remainder is the product of 3 times the square of the tens by the units of the root. If we then divide this remainder by 3 times the square of the tens, we shall find the missing unit factor that we are looking for.

3×5 (tens) squared is equal to 75 (hundreds). Dividing 324 (hun-

dreds) by 75 (hundreds) we have for a quotient 4 (units). This 4 we place as the units of the root.

Taking away from the remaining part of the power 3 times the square of the tens times the units, or 300 (hundreds) we have remaining 24 (hundreds), 6 (tens), and 4 (units).

In this remainder is the product of 3 times the tens by the square of the units. Three times the 5 (tens), or 15 (tens), times the square of the 4 (units), or 16 (units), equals 24 (hundreds). Subtracting the 24 (hundreds) from the remainder of the power, we have left 6 (tens) and 4 (units).

We have still to take out the cube of the units of the root. The cube of 4 units is 6 (tens) and 4 (units), or 64 units. Subtracting the 64 units we have a remainder of nothing.

ILLUSTRATIVE EXAMPLE.

What is the cube root of 34012224?

Abbreviated Work.

$$\begin{array}{r}
 3^3 = 27 \\
 3 \times 3^2 = 27 \overline{) 70} \\
 3 \times 2 \times 3^2 = 54 \\
 \quad \underline{161} \\
 3 \times 3 \times 2^2 = 36 \\
 \quad \underline{1252} \\
 2^3 = 8 \\
 3 \times 32^3 = 3072 \overline{) 12442} \\
 3 \times 32^2 \times 4 = 12288 \\
 \quad \underline{1542} \\
 3 \times 32 \times 4^2 = 1536 \\
 \quad \underline{64} \\
 4^3 = 64
 \end{array}$$

to the remainder, obtaining 70 (hundred thousands).

Analysis.

On separating the number into periods of three figures each, we find that the root contains three orders, hundreds, tens, and units. The largest cube found in the left hand period, 34 (millions), is 27 (millions). The cube root of 27 (millions) is 3 (hundreds). This 3 (hundreds) we express as the first, or hundreds order, of the root.

Subtracting 27 (millions) from 34 (millions) we have as a remainder 7 (millions), and as the next part of the power is found in hundred thousands as well as in millions, we annex the 0 of that order

to the remainder, obtaining 70 (hundred thousands). Considering the part of the root already found as tens of the following order, and knowing that the power still contains 3 times the square of the tens times the units, we obtain a divisor by squaring the 3 (hundreds) and multiplying it by three. This gives us a divisor of 27 (hundred thousands). Using this divisor for the dividend 70 (hundred thousands) we obtain for the next figure of the root 2 (tens). Subtracting 3 times 3 (hundreds) squared times 2 (tens), or 54 (hundred thousands) from the power we have left 16 (hundred thousands). As the next element

of the power, 3 times the tens by the square of the units is found in the ten thousands order as well as in the remainder that we already have, we annex the figure representing that order to our remainder, and then take from the number so formed 3 times the tens by the square of the units. Three times 3 (hundreds) times 2 (tens) squared is 36 (ten thousands). Removing this product from the power we have left 125 (ten thousands). Taking away the cube of the 2 (tens), or 8 (thousands) from the power we have left 1244 (thousands.)

We now consider the part of the root already found as tens of the root, and secure a trial divisor for obtaining the next order of the root in the same way as at first. Having found the units of the root we take out as before 3 times the tens squared times the units, and three times the tens times the units squared, and the cube of the units, and so continue until the last order of the root is found.

RULE FOR EXTRACTING THE CUBE ROOT.

1. *Point off the number into periods of three orders each, beginning with units' order.*
2. *Find the greatest cube in the left hand period of the power, and write its cube root as the first, or highest found order of the root.*
3. *Subtract this cube from the part of the power already used and annex the next order of the power to the remainder. This forms a dividend.*
4. *Divide this dividend by three times the square of the order of the root already found, as a trial divisor, and use the quotient as the next order of the root. (Note 1.)*
5. *Multiply the divisor by this order of the root and subtract the product from the dividend. To the remainder found annex the next order of the power. (Note 2.)*
6. *From this number subtract three times the product of the first order of the root by the square of the second order of the root.*
7. *From this remainder subtract the cube of the last order of the root.*
8. *Annex to this remainder the next order of the power, which divide by three times the square of the part of the root already found, and proceed as before.*

Note 1. If this divisor is too large for the dividend place a cipher for the next order of the root, two ciphers at the right of the divisor, and annex a full period to the dividend for a new dividend.

Note 2. If this product is larger than the dividend decrease the last

order of the root by 1 until such time as the product shall be less, going over the work and making the necessary adjustments.

Note 3. In case the number is not a perfect cube, annex periods of ciphers and carry the result to three or more decimal places.

Note 4. The cube root of a fraction may be exactly taken if both numerator and denominator are perfect cubes. If they are not the fraction may be reduced to the decimal form and the required root be then found.

Note. If not otherwise directed, pupils may find the roots of imperfect powers to three decimal places.

1. Find the value of the following: $\sqrt[3]{59319}$; $\sqrt[3]{592704}$; $\sqrt[3]{1860867}$; $\sqrt[3]{.000002197}$; $\sqrt[3]{20012.875875}$.

2. A cubical box contains 42875 cubic inches. What are its dimensions?

3. A pile of wood 3 times as long as it was wide and high, contained 238521 cubic feet. What was its height?

4. At \$5/8 per square yard, what would be the cost of lining a cubical box, holding 1000 cubic feet of water?

5. A room as long and wide as high, contains 4096 cubic feet of space. What is the distance round the room on the floor?

6. Find the dimensions that a bin, four times as long as wide and high, must have in order that it may hold 58 bushels of wheat. (2150.4 cubic inches are occupied by one bushel.)

7. Find the dimensions of a cellar of cubical form from which have been taken 800 cubic yards of earth.

8. Find one dimension of a bin of cubical form that will hold as many bushels as one that is 18 feet long, 6 feet wide, and $5\frac{1}{2}$ feet deep.

9. What will be the expense of lining the inside of a cubical box, holding 900 gallons of water, if the lining costs 83 cents per square yard?

10. 358 cords of wood were piled in the form of a cube. What were the dimensions of the pile?

MENSURATION.

PLANE FIGURES.

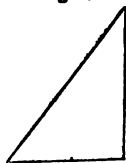
TRIANGLES.

Plane Figures are plane surfaces bounded by straight lines.

A Triangle is a plane figure bounded by three straight lines.

a. *A Right Triangle* is a triangle containing a right angle. (Fig. 1).

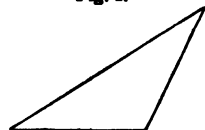
Fig. 1.



Right Triangle.

Fig. 2.

b. *An Obtuse-angled Triangle* is one containing an obtuse angle. (Fig. 2).



Obtuse-Angled Triangle

c. *An Acute-angled Triangle* is one in which all angles are acute angles. (Fig. 3).

Fig. 3.

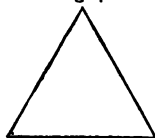


Acute-angled Triangle.

Fig. 4.

3).

d. *An Equilateral Triangle* is one having three equal sides. (Fig. 4).



Equilateral Triangle.

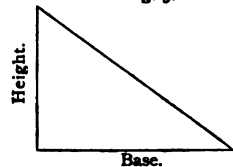
e. *An Isosceles Triangle* is one in which two of the sides are equal. (Fig. 5).

The Base of a triangle

Vertex.

Fig. 5.

is generally considered to be the side on which the triangle appears to rest, though any side of the triangle may be taken as the base. (Fig. 5).



The Vertex of the triangle is the angle opposite the base. (Fig. 5).

The Height of a triangle is the perpendicular distance from the base, or the base produced, to the vertex. (Fig. 5).

e. *The area of a triangle is equal to one half the product of the numbers representing its base and height.* (Fig. 6).

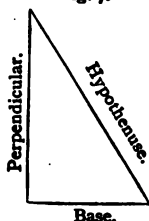


Fig. 7.

In a right triangle the following names are applied to the respective sides:

Hypotenuse. The side opposite the right angle. (Fig. 7).

Base. The side forming one boundary of the right angle. (Fig. 7).

Perpendicular. The side forming the other boundary of the right angle. (Fig. 7).

In Fig. 8, a right triangle has been constructed. Squares have been erected on each of its sides.

e. *The square on the hypotenuse of a right triangle is equal to the sum of the squares on the other two sides.*

f. *The square on the hypotenuse of a right triangle less the square on either of the other two sides equals the square on the remaining side.*

Note the formulas that follow :

$$1. H^2 = B^2 + P^2$$

$$2. H^2 - B^2 = P^2$$

$$3. H^2 - P^2 = B^2$$

NOTE. Illustrate with drawings the following problems, and solve by aid of the foregoing formulas :

1. What is the length of the third side of a right triangle having a base length of 30 feet, and a perpendicular of 48 feet ?

2. A straight cord, 90 feet in length, attached to the top

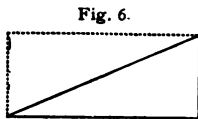


Fig. 6.

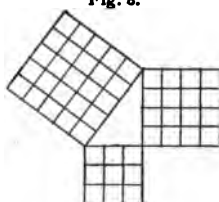


Fig. 8.

of a flag-pole, reaches the ground at a distance of 40 feet from the base of the pole. How high is the pole?

3. What is the area of a triangle that has a base length of 60 feet and whose vertex is 25 feet from the base line?

4. What is the diagonal length of a rectangular field having a length of 96 yards and a width of 78 yards?

5. Harry travels north from a given point, and William east from the same point. Harry walks 12 hours at the rate of $5\frac{1}{2}$ miles per hour, and William 10 hours at the rate of $4\frac{1}{2}$ miles per hour. At the end of their journeys how far apart are the boys?

6. The diagonal of a square field is 800 yards. What is the distance round the field?

7. Find the height of an isosceles triangle with a base of 22 feet and each of the other sides 30 feet.

8. The top of a tree broke partly off, and fell so as to touch the ground at a distance of 36 feet from the roots. How tall was the tree before the breaking, if the part left standing was 42 feet in length?

9. How wide is a street in which a cord 90 feet long stretched from a window 34 feet from the ground on one side of the street, will touch the base of the house directly opposite on the other side?

10. A boy flies a kite with 450 feet of cord attached. At a distance of 360 feet from the boy how high above the ground is the kite?

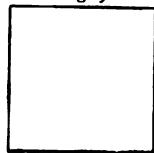
QUADRILATERALS.

A *Quadrilateral* is a plane figure bounded by four straight lines.

A *Parallelogram* is a quadrilateral having opposite sides parallel.

a. *A Square* is a parallelogram having equal sides and all angles right angles. (Fig. 9).

Fig. 9.



Square.

Fig. 10.

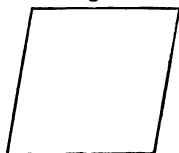


Rectangle.

b. *A Rectangle* is a parallelogram with opposite sides equal and with angles all right angles. (Fig. 10).

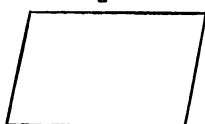
c. *A Rhombus* is a parallelogram with all sides equal and with no angles right angles. (Fig. 11).

Fig. 11.



Rhombus.

Fig. 12.

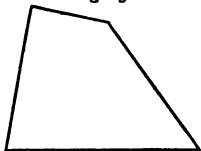


Rhomboid.

d. *A Rhomboid* is a parallelogram with opposite sides equal and no angles right angles. (Fig. 12).

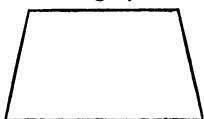
A Trapezium is a quadrilateral having none of its sides parallel. (Fig. 13).

Fig. 13.



Trapezium.

Fig. 14.



Trapezoid.

A Trapezoid is a quadrilateral having two sides parallel and two sides not parallel. (Fig. 14).

In a parallelogram any side may be considered as the base.

The Height of a parallelogram is represented by a perpendicular line drawn from the base to the opposite side, or to the opposite side produced.

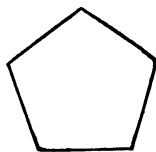
1. *The area of any parallelogram is equal to the area of a rectangle having the same base and height.*
2. *The area of any trapezoid is equal to half the sum of the parallel sides multiplied by the distance between them.*
3. *The area of a trapezium may be found by separating the figure into triangles and finding the sum of their areas.*

Note. Draw figures to illustrate the problems which follow and solve.

1. What is the area of the gable end of a barn having rafters 36 feet in length, if the ridgepole is 12 feet above the plates ?
2. Find the area of a triangular piece of land, the base being 65 rods in length and the vertex being 38 rods from the base.
3. A field in the form of a square contains 4096 square rods; what is its diagonal length ?
4. A rectangle whose width is to its length as 216 is to 288 would have its diagonal represented by what number ?
5. Find the area of a trapezoid with parallel sides of 40 and 68 rods, and a distance between them of $29\frac{1}{2}$ rods.
6. The distance round a rhombus is 160 feet. From one corner of the same to the opposite corner is 64 feet. What is the area of the rhombus ?
7. One of the parallel sides of a trapezoid is 240 rods, and the opposite side is $\frac{3}{4}$ as long. The distance between the opposite sides is $\frac{1}{2}$ the shorter parallel side. Find the area of the trapezoid.
8. A field in the form of a trapezoid contains $11\frac{1}{4}$ acres. If the parallel sides are 60 rods and 40 rods, how far apart are they ?
9. How many feet of boards in the four sides of a barn, 60 feet by 48 feet, and 20 feet to the eaves, if the ridgepole is $43\frac{1}{2}$ feet from the ground ?
10. A lot of land lies between two parallel streets 200 feet apart. If the land measures 180 feet on one street and 224 feet on the other, what is the area of the lot in square rods ?

POLYGONS.

Fig. 15.



Regular Polygon.

A Polygon is any plane figure bounded by straight lines.

A Regular Polygon is one having all its sides and all its angles equal. (Fig. 15).

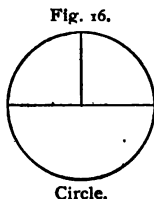
Note. All plane figures that we have noticed are polygons.

CIRCLES.

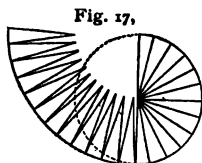
A Circle is a plane figure bounded by an equally curved line called its circumference. (Fig. 16.)

The Center of a circle is a point within the circle equally distant from all parts of the circumference. (Fig. 16.)

The Diameter of a circle is a straight line drawn through the center of the circle each end of which terminates in the circumference. (Fig. 16.)



A Radius is one half of a diameter. (Fig. 16.)



It will be seen by reference to Fig. 17 that a circle may be considered as made up of a number of isosceles triangles whose bases are the circumference of the circle, and whose equal sides are radii of the circle.

Applying the rule for the finding of the area of triangles we see that

The area of a circle is equal to one half of the circumference of the circle times the radius.

The relations between the different parts of the circle are also expressed in the following formulas :

1. Circumference = Diameter \times 3.1416
2. Diameter = $\frac{\text{Circumference}}{3.1416.}$
3. Circumference = 2 (Radius \times 3.1416.)
4. Radius = $\frac{\text{Circumference}}{2 \times 3.1416.}$

$$\begin{array}{ll}
 5. \text{ Area} & = \text{Radius}^2 \times 3.1416. \\
 6. \sqrt{\text{Area}} & = \text{Radius.} \\
 & \text{3.1416}
 \end{array}$$

Note. 3.1416 $3\frac{1}{7}$ nearly.

Illustrate the work in solving the following problems :

1. What is the area of a circular pond with a diameter of 95 rods ?

2. How long must a cord be that attached to a stake will allow a horse to graze over an area equal to 1 acre ?

3. A bicycle wheel in turning round once goes over 18 feet of ground. What is the length of one of the spokes ?

4. A square is inscribed within a circle. The diagonal of the square is 5 feet. What is the area of the surface of the circle not included in the square ?

5. What is the area of a circle inscribed within a square that is 4 feet on a side ?

SIMILAR PLANE FIGURES.

Similar Plane Figures are plane figures that have the same shape.

1. *The areas of similar plane figures are to each other as the square of their like dimensions.*

1. A square is 12 rods long, and contains 144 square rods. What is the area of a square that is 23 rods long ?

2. If the area of a circle with a radius of 12 inches is 453 square inches, what will be the area of a circle 4 feet in diameter ?

3. If a pipe that is 4 inches in diameter discharge 100 gallons of water in a certain time, how much water in the same time will a pipe 7 inches in diameter discharge ?

4. Compare the areas of two circles, one having a circumference of 1 mile and the other having a diameter of 500 feet.

5. The area of a triangle that is four feet on one of its sides is 80 square feet. What is the area of a similar triangle with a corresponding side of 9 feet?

SOLIDS.

THE SPHERE.

A Sphere is a solid bounded by an equally curved surface, every part of which is equally distant from a point within called the center. (Fig. 18.)



Fig. 18.

Sphere.

The Diameter of a sphere is a straight line passing through the center of the sphere, the ends of which terminate in the surface.

The Radius of a sphere is one-half of its diameter.

1. *The area of a sphere is equal to the square of the diameter times 3.1416.*
2. *The volume of a sphere is equal to one sixth of the cube of the diameter times 3.1416.*

THE CYLINDER



Cylinder.

A Cylinder is a solid formed by revolving a rectangle with one of its sides as the axis. (Fig. 19.)

1. *The convex surface of a cylinder is equal to the circumference of the base times the height.*

The volume of a cylinder is equal to the area of the base times the height.

Fig. 20.



Cone.

THE CONE.

A Cone is a solid that is formed by revolving a right angle with its base as the axis of revolution. (Fig. 20.)

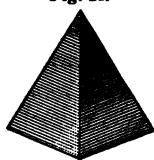
1. *The convex surface of a cone is equal to the product of one half of the slant height, and the circumference of the base.*
2. *The volume of a cone is equal to one third of the volume of a cylinder having the same base and perpendicular height.*

THE PYRAMID.

A Pyramid is a solid having for its base any polygon and for its other surfaces triangles, meeting at a common point called the vertex. (Fig. 21.)

1. *The surface and volume of a pyramid are found in the same way as are the surface and volume of the cone.*

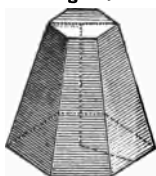
Fig. 21.



Rectangular Pyramid.

THE FRUSTUM.

Fig. 22.



Frustum of Pyramid.

The Frustum of a cone or pyramid is the portion of the same left after a part has been cut off by a plane parallel to the base. (Fig. 22.)

1. *The volume of a frustum of a cone or pyramid is equal to one third of the product of the height multiplied by the sum of the areas of the bases plus the square root of the product of the areas of the bases.*

THE PRISM.

A Prism is a solid two of whose faces are equal and parallel polygons, and whose other faces are rectangles. (Fig. 23.)

1. *The volume of a prism is equal to the product of the area of the base by the height.*

Solve the following problems, illustrating the work with drawings:

Fig. 23.



A Prism.

1. If the earth's diameter is 7912 miles, what is its superficial area? What is its volume? Express the last question.

2. Find the area and the volume of a cylinder formed by revolving a rectangle 10 inches by 7 inches on its shorter side.

3. A cone and a pyramid stand side by side. The base of the cone is a circle with a diameter of 16 feet and a slant height of 20 feet. The base of the pyramid is a square 20 feet on a side and with a slant height of 22 feet. Find and compare the surface measures of the two solids.

4. What is the volume of a triangular prism having a height of 7 feet, and a base area of 15 square feet?

5. A mill-hopper 6 feet square on the top and 2 feet square on the base, has a depth of $3\frac{1}{2}$ feet. How many bushels will it hold?

SIMILAR SOLIDS.

Similar Solids are solids whose shapes are alike.

1. *The volumes of similar solids are to each other as the cubes of their like dimensions.*

Solve the following problems :

1. One sphere is 3 feet in diameter ; another sphere is 27 feet in diameter. Compare the volumes of the two spheres.

2. A bullet of lead $\frac{3}{8}$ inches through weighs $\frac{7}{11}$ ounces. What will be the weight of a leaden ball 1 foot in diameter?

3. A cylinder 5 inches across of a certain height will hold a pint of water. What will be the capacity of a cylinder of the same height and 3 feet across?

4. If the bulk of one body be 10,000 times as great as that of another what are the proportional diameters of the two bodies?

5. A cheese 26 inches across weighs 64 pounds ; what will be the distance across a cheese of the same height that weighs 44 pounds?

GENERAL REVIEW PROBLEMS.

I.

In a two-story school house, 80 feet long, 60 feet wide, with side walls 28 feet high, are 16 windows, 7 feet 4 inches by 3 feet 2 inches, wainscoted 2 feet above the floor, with a 12 foot hall running lengthwise, and 2 partitions across each room. The roof is half pitched and projects 3 feet; the peak being 16 feet above the side walls. The foundation walls are 4 feet high and 2 feet thick. The brick part of the wall is 18 inches thick, and 2 feet high above the foundation. There is to be no allowance made for doors or other openings excepting the windows, which are to be taken out in all estimates.

1. Find the amount of matched lumber necessary to sheathe and side the building, allowing $\frac{1}{8}$ for matching in sheathing, and $\frac{1}{8}$ for laps in siding.
2. Find the cost of shingles required for the roof, at \$4.50 per square, and the cost of the labor for sheathing, siding, and shingling at \$1.62 $\frac{1}{2}$ per square.
3. Find the cost of lathing and plastering at 28 cents a square yard, and the cost of flooring at \$22 per M., with 20% allowance for matching.
4. Find the number of rolls of paper, 24 yards long, and 18 inches wide required to paper the walls, with an allowance of 12 $\frac{1}{2}$ % waste in matching.
5. Find the number of perches of stone in the foundation wall; also the number of bricks.

6. How large must a case be made to hold a great, great gross of crayons, if a box which holds a gross is 7 inches long, $4\frac{1}{2}$ inches wide, and 4 inches deep?

7. A cubical bin holds 600 bushels of wheat. What are its dimensions, practical measurement?

8. The diameter of a cistern is 7 feet 6 inches at the top, and 9 feet at the bottom, with a height of 6 feet. How many gallons will it hold?

9. A man having spent \$25 more than 40% of his money, had \$70 more than $\frac{1}{3}$ of it left. What per cent. of his money did he have left?

10. How many surface feet in a cubical block of granite 5 feet 4 inches on each edge?

II.

1. A man sold a horse for \$156 and thereby lost \$26. What was his loss per cent?

2. What is the exact interest at $6\frac{1}{2}\%$ on \$1800 for the first three months of the year 1894?

3. A dealer bought coal at \$3.76 per ton. What must he ask per ton that he may deduct 15% from his asking price, and still make a profit of $12\frac{1}{2}\%$?

4. How many bricks of the ordinary size will be needed to pave a yard 6 rods long and 4 rods wide?

5. A merchant hires money at 6% and invests it in flour at \$7.50 per barrel. After keeping the flour 60 days, he is obliged to sell it at \$7.35 a barrel. What per cent. does he lose?

6. A park, 100 rods long and 80 rods wide, is surrounded by a walk 15 feet wide. How many yards of macadam will be needed to cover it four inches deep?

7. A rectangular cistern the length of which is 16 feet, and the breadth 6 feet, when $\frac{3}{4}$ full contains 450 cubic feet of water. What is the depth of the cistern?

8. When brooms are sold at \$3.50 per dozen with a cash discount of 5% on all bills over \$100, what would be the cost of $16\frac{1}{2}$ gross?

9. How many acres in a circular field the circumference of which is 3141.6 feet, and the radius 500 feet?

10. A square field, containing $6\frac{1}{4}$ acres, is surrounded by a close board fence 12 feet high. What did the boards cost at \$11 per M.?

III.

1. The dial of a tower clock is 18 feet in diameter. Find its area in square feet.

2. What is the area of a circular pond with a radius of 300 feet?

3. How much sheet iron will it take to cover the entire surface of a land roller 8 feet long and 3 feet in diameter?

4. How many gallons of water, practical measurement, will a cylindrical cistern hold that is 11 feet in diameter and 14 feet deep?

5. In the loft of my barn, on the Riverside farm, is a water tank 12 feet deep and 9 feet in diameter. What is its capacity in barrels?

6. The radius of the dome of a World's Fair Building was 36 feet. How many feet of flooring was required for it, if the waste in matching and fitting was 20%?

7. A roller $8\frac{1}{4}$ feet long and $8\frac{1}{4}$ feet in circumference, revolves 100 times in crossing a rectangular field, and takes ten minutes to make the round trip. How much land can a man roll in four hours with this roller, if no laps are made?

8. The distance around a circular race track is $\frac{1}{2}$ of a mile. The track is four rods wide. How much land within the circle exclusive of the track?

9. A vat that will hold 1000 gallons of water will hold how many bushels of wheat?

10. \$5000.

CHICAGO, July 9, 1893.

Ninety days from date, for value received, I promise to pay to the order of J. WESLEY VAN DERVOORT, five thousand dollars, with interest at 7%.

Discounted July 9, 1893 at 6%.

Find proceeds of above note.

J. H. MORAN.

IV.

1. When brooms are \$5.50 per dozen, what will 18 $\frac{3}{4}$ gross cost, if a discount of 10% is allowed for cash?

2. A man selling tea on 2 $\frac{3}{4}$ % commission, sends his employer \$875.25 as the net proceeds of one week's sales. What was the amount of his average daily sales?

3. A dealer sold a horse for \$90 and lost 25% on the cost. He sold a second horse at a gain of 20% on the cost, and made as much as he lost on the first horse. For how much did he sell the span?

4. At what price must I buy 6% city bonds to make 8% on my investment?

5. What is the amount, by the exact interest method, of \$475 at 10%, from January 17, 1894, to April 5, 1894?

6. I sold L. C. M. and B. R. R. stocks, which I bought for $1\frac{1}{3}$ % below par, at $1\frac{1}{3}$ % above par, gaining \$128. How many shares of \$100 each did I sell?

7. \$1000.

SAVANNAH, GEORGIA, Oct. 4, 1893.

Six months after date, for value received, I promise to pay John Hopkins, or order, one thousand dollars, with interest at 7%.

JAMES WHITE.

Find the proceeds of the above note, discounted Dec. 31, 1893, at 8%?

8. \$2000.

BUFFALO, N. Y., Jan. 1, 1891.

For value received, I promise to pay John Spencer, two thousand dollars, on demand, with interest at 7%.

SAMUEL SNYDER.

On this note were the following endorsements :

November 28, 1891, \$125.

August 1, 1892, \$1850.

What was due Jan. 1, 1893?

9. How many bushels of nuts can be bought for \$16, if 12 quarts cost \$1.28?

10. If 5 men can build 60 rods of wall in 16 days, how many men will be required to build 120 rods in 20 days?

V.

1. If I sell 250 bushels of wheat for \$350, and thereby gain 16 $\frac{2}{3}$ %, for how much per bushel should I have sold the wheat to lose 12 $\frac{1}{2}$ %?

2. If I fall 5% from my asking price, which is 40% advance on the cost, what % will I gain?

3. A speculator sold beef at \$20 per barrel, $\frac{1}{3}$ of which equaled his gain. What % would he have gained had he sold the beef at \$24 per barrel?

4. I deposited \$300 in bank on July 1, 1890. How much is due me Jan. 1, 1892, if the bank pays 8% per annum interest, and credits the interest semi-annually to my account?

5. Write a note which, if due in 45 days, and discounted at a bank at $\frac{3}{4}$ % per month, will yield \$1185.60.

6. At 12 cents per bag, what is the duty on 89 bags of salt of 100 pounds each, gross weight, tare 2%?

7. A person having a six-months' note for \$1200, dated May 2, 1893, gets it discounted on the following 8th of June, at 6%, and invests the proceeds in land at \$10 per acre. How many acres of land does he buy?

8. If the property in a town is assessed at \$3875500, and the amount raised from a poll tax is \$1241, what rate will enable the town to pay for sewers that cost \$71000?

9. If, in 16 days of 9 hours each, 9 bricklayers lay a wall 96 feet long, 21 feet high, and $1\frac{1}{4}$ feet thick, in how many days of $11\frac{1}{4}$ hours each, can 12 bricklayers lay a wall 126 feet long, 28 feet high, and $1\frac{1}{2}$ feet thick?

10. If 3 men can lay a sidewalk 240 feet long and 6 feet wide in 15 days, in how many days can 5 men lay a walk 180 feet long and 4 feet wide?

VI.

1. For what sum must I draw my note on 4 months' time to borrow \$2685 from a bank in Wisconsin?

2. I was offered a discount of 25%, and 10% off for cash, or a discount of 10%, and 25% off for cash. In % which was the better offer?

3. At 5% what is the interest on 5 pounds, 16 shillings, 9 pence for 2 years, 6 months, 9 days?

4. I sold stock for 75 that cost me 80. How many shares did I sell if I lost \$2,000 by the transaction?

5. I wish to borrow \$3000 for 90 days. How much more will it cost me to borrow from a bank than from a private source, if the rate in each case is 6%?

6. A can do a piece of work in 6 days of 8 hours each, and B in 4 days of 10 hours each. How many days of 9 hours each will it take them to do the work if they labor together?

7. How long will it take 6 men to do a piece of work that can be done by 18 men in 6 days?

8. If 24 men by working 24 days of 8 hours each, can dig a ditch 95 rods long, 12 feet wide, and 9 feet deep, how many men in the same number of days of 12 hours each, will be required to dig a ditch 380 rods long, 9 feet wide, and 6 feet deep?

9. A, B, and C entered into partnership. A put in \$340, B, \$460, and C, \$500. What was each man's share of a gain of \$390?

10. The profits of a partnership of one year's standing were \$1943.76. A furnished 4 times the amount of capital that B did; B put in $\frac{1}{2}$ as much as C; and D provided as much as A and B together. What is the profit of each?

VII.

1. Within a circular plot of ground is a rectangular pond, 80 feet by 15 yards, and covering $12\frac{1}{2}\%$ of the area of the plot. Find the number of rods of fence necessary to enclose the plot?

2. A sugar refiner imports 72 casks of West India sugar, gross weight 1975 pounds each; tare $12\frac{1}{2}\%$; invoiced at 6 cents per pound. Tariff rates are 2 cents per pound, specific, and 25% *ad valorem*. What are the *custom house* charges?

3. If I sell \$10,000 in U. S. 6's, at 107, and with part of the proceeds buy N. Y. C. 6's at 90 sufficient to yield \$300 annually, how much of the money from the sale of the government bonds shall I have remaining?

4. If 8 horses in 14 weeks consume 5.65 tons of hay, how long will 11.3 tons last 7 horses?

5. What per cent. of the number of square feet in the

surface of a cube 8 feet high, is the number of cubic feet in its volume?

6. I paid \$675 for a building lot, $3\frac{1}{2}$ rods front by 11 rods deep. I afterward bought another lot $3\frac{1}{2}$ rods front by $13\frac{1}{2}$ rods deep at the same rate. What did I pay for the second lot?

7. I purchased for a cloak $5\frac{1}{2}$ yards of cloth, $1\frac{1}{4}$ yards wide. Flannel, $\frac{7}{8}$ of a yard wide, which shrunk in wetting $\frac{1}{8}$ of a yard in width and $\frac{1}{10}$ of a yard in length, was bought to line the cloak. How many yards of flannel were bought?

8. At \$1.50 per rod, how much more will it cost to fence a ten-acre lot in the form of a square than in the form of a circle?

9. How many acres of land in a triangular field the base of which is 141 rods and the altitude 56 rods?

10. A ladder 40 feet long is placed against a wall 14 feet high. The top of the ladder touches the top of the wall. With the foot of the ladder in the same position the top will reach the top of a wall opposite that is 26 feet high. How far apart are the walls?

VIII.

1. January 3, 1894, I took a note for \$344, due in 9 months, with interest at 6%. On March 16, I had it discounted at a bank in New Jersey, at the legal rate. How much did I realize from the note?

2. How many loaves of bread weighing 12 ounces each may be baked from a barrel of flour, if the bread made is 32% heavier than the flour from which it is made?

3. The rate of tax in a town is 8 mills on the dollar. Mr. Burling is assessed \$5450 for his house and \$2250 on his personal property. He pays his tax from the proceeds of a note for \$450 which is to mature in 63 days and that he gets

discounted at 6%. How much of the proceeds of the note will he have left after paying his tax?

4. A bankrupt owed \$550 to Smith, \$675 to Brown, and \$875 to Overton. His assets were \$1043.28. What did each creditor receive?

5. If it costs \$312 to enclose a field in the form of a rectangle that is 216 rods by 24 rods, what will it cost to enclose the same area of land in the form of a square, at the same rate per rod for fencing?

6. What is the diagonal distance across a rectangular field 85 rods long and 63 rods wide?

7. The rafters of a house are $16\frac{1}{2}$ feet long and the gable is $26\frac{1}{2}$ feet wide. How high above the eaves is the gable peak?

8. What is the area in acres of a triangular field with a base of 85 rods and an altitude of 75 rods?

9. Find the surface and volume of a cylindrical block 10 feet high and 3 feet in diameter.

10. What must be the length of a ladder to reach to the top of a chimney 50 feet in height, if the base of the ladder is to stand 15 feet from the base of the chimney?

IX.

1. Bought a farm for \$2400, and at the end of 2 years 6 months sold it for \$3000. What was the rate of gain?

2. From a pile of 4-foot wood, 244 feet long and 5 feet high, $66\frac{2}{3}\%$ was sold for \$152.50. What was the price per cord?

3. A contractor received \$247.50 for flagging $87\frac{1}{2}\%$ of a court-yard 30 feet long, at \$2.75 per square yard. What was the width of the yard?

4. What is the length in yards of the longest straight line that can be made on the floor of a room 30 feet by 40 feet?

5. Find the area of a cubical block the edge of which measures 10 feet.

6. What depth of rainfall upon a roof, 30 feet by 40 feet, will fill an 80-hogshead cistern?

7. A flag-staff 36 feet high was broken off $\frac{1}{3}$ of the way up. How far from the ground did the top strike?

8. A square flower garden has a walk extending around it. The area of the walk is 2550 square feet, and its width is $8\frac{1}{2}$ feet. How many square rods in the garden, not including the walk?

9. A coal bin 15 feet long, 8 feet wide, and $7\frac{1}{2}$ feet deep, will store how many tons of anthracite coal, if two bushels weigh 150 pounds?

10. Find the side of a square that can be inscribed within a circle 15 feet in diameter.

X.

1. What is the distance through the center of a yard 10 rods square from one corner to the diagonally opposite corner?

2. Two ships sail from the same port; one goes due north 128 miles, and the other due east 72 miles. How far are they apart?

3. How many square feet of zinc will it take to line the sides and bottom of a cubical vat which contains 10000 gallons?

4. If \$500 at 8% interest produce \$150 in 3 years 9 months, how long will it take to produce the same amount at 10%?

5. A farmer having 10½ bushels of wheat, sold $4\frac{1}{2}$ bushels of it. What $\%$ of the whole had he remaining?

6. Required the number of square feet in the surface of a walk surrounding a circular garden which is 25 feet in diameter, the walk being $2\frac{1}{2}$ feet wide.

7. Some wheat sold for \$90, which was 10% less than the original cost. What would have been the gain %, if it had been sold for \$150?

8. A company of 4 persons built a summer hotel. The first person furnishing $\frac{1}{4}$ of the capital, the second $\frac{1}{8}$, the third $\frac{1}{16}$, and the fourth the balance. The hotel was rented for \$15000, for the season. Divide the money received for the rental according to the amount of capital furnished by each person.

9. In a business of which the capital is \$60000, A furnishes 35% of it for 8 months, B 45% of it for 9 months, and C the remainder for 10 months. Apportion a gain of \$12000.

10. A walk 4 feet wide is laid out around a circular plot of ground which has a radius of 100 feet, inside the walk. What is the area of the walk?

XI.

1. Find the inside measurement of a cubical bin which when $\frac{3}{4}$ full holds 800 bushels of oats.

2. I had a sum of money invested in a 7% farm mortgage, which I changed into 10% railroad stock at 80. Did I gain or lose and what per cent.?

3. A farmer sold a cow for \$75 and lost 25%. He then sold another at an advance of $16\frac{2}{3}\%$, and gained as much as he lost on the first. What was the cost of the second cow?

4. Find the proceeds of a note for \$650, payable in 90 days with interest at 6%, discounted 30 days after date at 7%.

5. I want to borrow \$395.80 from a bank. For what amount must I make my note for 60 days to be discounted at 6%?

6. Find the dimensions of a circle the area of which is equal to a square 40 rods on each side.

7. The width of my barn is 42 feet, and the two gables are 18 feet above the eaves. How long are the rafters if they project 2 feet over the sides?

8. If a pile of wood 128 feet long, 4 feet wide, and 8 feet high, is worth \$152, how high must a pile of wood be which is 60 feet long, 4 feet wide, and is worth \$42.50?

9. I bought a span of horses for \$400. What must I ask for them in order to fall 20% from the asking price and still gain 25% on the cost?

10. At \$15 an acre, what is the value of a right-angled triangular piece of land 76 rods long on the south side, and 45 rods long on the east side?

XII.

1. I paid 40% of the cost of a house when I bought it, $\frac{2}{5}$ of its cost at the next payment, and 20% of the cost at the third payment. What was the price of the house if I still owe \$960?

2. A horse and carriage cost \$570. What was the cost of each if the horse cost $137\frac{1}{2}\%$ as much as the carriage?

3. What is the duty on 850 yards of French cloths, invoiced at \$1.50 per yard, if the specific duty is \$.40 a yard, and the *ad valorem* duty 20%?

4. What is the compound interest at 4% on \$1800 from June 19, 1890, to April 12, 1894, computed annually?

5. Two men hired a pasture for \$410. A puts in 300 sheep for 5 months, and B 450 sheep for 6 months. What part of the rental should each pay?

6. At \$.75 a rod, how much more will it cost to fence 10 acres of ground in the form of a square, than in the form of a circle?

7. Mr. Morgan invested \$82450 in 6% bonds at 9%. What will his income be from the investment?

8. Find the proceeds of a 60-day note for \$4800, bearing 7% interest, when discounted at date, at 6%.

9. What is the area of a right-angled triangular piece of ground, the north line of which is 1200 feet long and the west line 300 yards long?

10. At \$75 an acre what is the value of a farm in the form of a trapezoid, the parallel sides of which are 120 rods and 80 rods respectively, and the altitude of which is 64 rods?

XIII.

1. If a piece of silk cost \$1.20 a yard, at what price must it be marked, that it may be sold at 10% less than the marked price, and still a profit of 20% be made?

2. What will it cost to paint the outside of a cubical box 4 feet on each edge at 20 cents per square yard?

3. The distance around a circular park is $1\frac{1}{2}$ miles. How many acres does it contain?

4. A field is 208 rods long and 13 rods wide. What is the length in feet of a square field of equal area?

5. A steamer goes north at the rate of 15 miles an hour, and another west at the rate of 18 miles an hour. How far apart are they at the end of six hours?

6. In the centre of a square garden there is a circular pond covering an area of 810 square feet, which is $\frac{1}{16}$ of the whole garden. How many rods of fence will inclose the garden?

7. Two rafters each 20 feet long meet at the ridge of a

roof 12 feet above the base of the gable. What is the width of the house?

8. A, B, and C invest \$4860 in trade. A invests twice as much as B, and C invests twice as much as A and B together. They gained 40% on their investment. What is each person's share?

9. In the Yosemite Valley is the stump of a tree 32 feet across. Allowing $2\frac{1}{2}$ square feet as standing room for one person, how many persons can stand on the stump?

10. What is the greatest distance between any two points in a room that is 36 feet long, 27 feet wide, and 16 feet high?

XIV.

1. If a merchant sells tea at 66 cents a pound and gains 20%, what per cent. would have been gained had it been sold at 77 cents a pound?

2. What annual income shall I receive from an investment of \$15860 in R. R. stock at 99%, if 4% semi-annual dividends are declared, brokerage $\frac{1}{8}\%$?

3. Jones holds two notes against Smith; one for \$356 due May 6, 1893, and the other for \$175.50 due Sept. 25, 1893. How much money will cancel both notes Oct. 11, 1891, money being worth 6%?

4. If a loaf of bread weighing $12\frac{1}{2}$ ounces is worth 10 cents, when flour is \$4 a barrel, what is the value of a loaf weighing 10 ounces, when flour is worth \$6.40 per barrel?

5. A, B, and C trade in company. A puts in $\frac{1}{2}$ of the capital, B $\frac{1}{3}$, and C the remainder. How shall a gain of \$2150 be divided among them?

6. What is the width of a park in which stands a flag-pole 240 feet high, from the top of which to one side of the park is 300 feet and to the opposite side 400 feet?

7. How many acres in a field 130 rods square, and how many rods of fence will be needed to fence from the N. E. corner in a straight line to the S. W. corner of the field?

8. How long a rope will it take which, when fastened to a post, will sweep over $1\frac{1}{4}$ acres of ground?

9. In a square lot containing $1\frac{3}{8}$ acres, how far is the centre from each corner?

10. Peter lives 40 rods east of John, 72 rods west of Charles, and 30 rods north of the school-house. If John and Charles both call for Peter in going to school, how much farther does each boy travel than if he had gone in a straight line from his home to the school-house?

XV.

1. Bought some stock at 92, and sold it at $94\frac{1}{4}$. The usual brokerage was paid on each transaction. The profit being \$398.25, how many shares were there?

2. A cistern $6\frac{1}{2}$ feet in diameter and 8 feet deep contains how many gallons?

3. How many yards of fence will be required to enclose a triangular field, the base being 80 rods and the altitude 28 rods?

4. A ladder 39 feet long reaches the top of a building 36 feet high. How far from the building does its foot rest?

5. Required the outer surface of an open tank, 8 feet in diameter, and 6 feet deep.

6. What are the dimensions of the ends of the largest stick of square timber that can be cut from a log 22 inches in diameter?

7. What is the area of a triangle the sides of which are respectively, 7 feet, 11 feet, and 12 feet?

8. Find the entire surface of a cylinder 12 feet long, the diameter of the ends being 2 feet 3 inches.

9. What is the distance from the centre to each corner, and to the middle of each side of a square, the area of which is $22\frac{1}{2}$ acres?

10. At \$1.20 cents per rod, which will cost the more and how much, to fence a circular field, 120 rods in diameter, or a square field which contains 90 acres?

XVI.

1. A note for \$1740 bearing 6% interest and dated June 12, 1893, payable in six months, was discounted at a bank Nov. 15, 1893, at 7%. What was the proceeds?

2. A line 62 feet long reaches from the top of a house 48 feet high, to the bottom of a house on the opposite side of the street. Find the width of the street.

3. What is the surface of a block 4 feet long, $2\frac{1}{2}$ feet wide, and 2 feet high, and the greatest diagonal distance through the block?

4. A circular plot of ground contains $\frac{3}{4}$ of an acre. What is its diameter?

5. At 25 cents a square foot, how much will it cost to line the sides and bottom of a tank which holds 472.5 gallons?

6. What is the length of the longest straight line that can be drawn in a room 14 feet high, 40 feet long, and 28 feet wide?

7. If it cost \$240 to inclose a square field containing 40 acres, how much will it cost to inclose the same area in a circular field with the same kind of fence?

8. The volume of a cube is two cubic yards 14 cubic feet 145 cubic inches. Find in inches its edge, and also its longest diagonal to two places of decimals.

9. How much greater is the area of a lot 50 rods square than that of a lot containing 50 square rods?

10. The sides of a field are 22 rods and 86 rods, respectively, and the distance between the sides is 18 rods. How many acres in the field?

XVII.

1. What is the length in rods of the longest straight line that can be drawn on a section of land?

2. In a township there are 23040 acres of land. At 75 cents a rod what would be the cost of inclosing the same with a fence?

3. At ten cents a square foot, what will it cost to line the bottom and sides of a cubical vat, the capacity of which is 450 gallons?

4. What is the area in acres of a square lot that can be laid off inside of a circular plot of ground the diameter of which is 40 rods?

5. If it requires 660 feet of lumber to board the two gables of a pitched roof barn 36 feet wide, how high is the ridge pole above the level of the eaves?

6. At 28 cents a square yard, what will it cost to paint the outer surface of a cylindrical tank 9 feet long and 6 feet in diameter?

7. What is the area of the sides and base of an equilateral triangular pyramid, the sides of the base each being 49 feet, and the slant height 147 feet?

8. Find the surface of a quadrilateral pyramid when the sides of the base are each 30 feet and the slant height is 65 feet.

9. The frustum of a cone has a slant height of 40 feet; at

the top it has a radius of 15 feet; and at the base a diameter of 50 feet. Find the convex surface, also the area of both top and bottom.

10. How many cubic feet in a quadrilateral pyramid, 6 feet on each side of the base, having a slant height of 21 feet?

XVIII.

1. Mr. Grant has a farm the parallel sides of which are $\frac{1}{4}$ of a mile apart. One of these sides is 60 rods long and the other 80 rods. How many acres in his farm?

2. The length of a rectangular ten-acre lot is twice its width. What is the length in rods of the longest straight line that can be drawn upon its surface?

3. What is the distance in rods from the centre to each corner of a N. E. quarter section of land?

4. The rafters of a two-gabled house are each 35 feet long, and meet at the peak of the roof, 15 feet perpendicularly from the base line at the eaves. What is the width of the house?

5. A fence one mile in length surrounds a circular race-course. How many acres of land in the enclosure?

6. What is the longest imaginary line that could be drawn through a cubical block of marble containing 1536 surface feet?

7. One of the Egyptian pyramids is square at its base, and measures 693 feet on each side. Its slant height is 495 feet. How many acres of land would the four convex sides and the base cover?

8. What is the entire surface of a cone, if the base is 12 feet in diameter, and the altitude is 36 feet?

9. Find the number of acres in a triangular field, the sides of which are 48, 54 and 60 rods, respectively.

10. What is the surface of a triangular prism if the sides of the base are 6, 9 and 12 feet, respectively, and the altitude is 16 feet?

XIX.

1. What would be the cost of a cylindrical water tank $7\frac{1}{2}$ feet in diameter, 8 feet high, made of two inch material, at \$60 per M? The cost of building was \$7.50 and of painting the outside \$1.18 per "square."

2. A piece of land in the form of a trapezoid has two right angles, with parallel sides 24 rods and 32 rods, and a slanting side of 40 rods. Find the area in acres.

3. A triangular field, the base of which is 50 rods and the altitude 48 rods, produced 400 bushels of oats. What was the yield per acre?

4. Each side of a triangular pyramid is 10 feet at the base, and the slant height 24 feet. What is the area of the sides and base?

5. Find the area of the sides and base of the frustum of a pyramid, the base being 25 feet square, the top 16 feet square, and the slant height 49 feet.

6. What is the entire surface of a cone, the base of which is 4 feet in diameter, and the slant height 5 feet?

7. What are the solid contents of a cone, the perpendicular height of which is 18 feet, and the base 10 feet in diameter?

8. How many acres of land in a triangular field, the sides of which are 50 rods, 64 rods, and 94 rods, respectively?

9. Find the difference between the entire surface of a triangular prism 12 feet long, the sides of which are 6 feet

each, and the entire surface of a cylindrical prism of the same length, the perimeter of its base being 18 feet.

10. The frustum of a pyramid has an altitude of 20 feet, a top 6 feet square, and a base 25 feet square. Find the solid contents.

XX.

1. A cow is fastened to a stake with a swiveled chain. If the chain is 40 feet long, over what space can the cow graze?

2. A horse was tied by a rope 52 feet long, fastened to the top of a stake 8 feet high. Over what area can he feed?

3. The area of a right-angled triangle is 30 square rods. If the base is 12 rods, what is the length of the long side?

4. What is the perimeter of $\frac{1}{4}$ of a section of land?

5. What is the area in acres of a field in the shape of a trapezium, the diagonal of which is 42 rods, the perpendiculars to the diagonal line being 16 rods and 18 rods, respectively?

6. Find the entire surface and volume of a pyramid the base of which is a rectangle 90 feet square, and the edges meeting at the vertex being 150 feet long.

7. A cubical vessel contains $39062\frac{1}{2}$ pounds of pure water. Find the length of an inner edge of the vessel in feet.

8. What is the diameter of a circle equal in area to a square 50 feet on a side?

9. Find the surface of a globe having a circumference of 39.27 inches.

10. Find the solid contents of a sphere, the diameter of which is 10 feet.

DEFINITIONS, PRINCIPLES, FACTS, AND RULES.

The four classes of numbers used in arithmetical computations, are integers, decimal and common fractions, and compound numbers, applied by the use of the four fundamental processes.

1. **A Quantity** is any thing that has size or value.
2. **A Unit** is a single *thing*.
3. **An Integral Unit** is one from which the number, either whole or fractional is derived.
4. **A Decimal Unit** is one of the parts of a unit obtained by dividing the same into tenths, hundredths or thousandths, etc.
- A Fractional Unit** is one of the parts into which a unit is divided.
5. **An Abstract Number** is one used without reference to any particular thing or quantity ; as six, nine.
6. **A Concrete Number** is one used with reference to some particular thing or quantity ; as 6 boys, 9 pounds.
7. **Like Numbers** are those which express units of the same kind ; 3 feet, 6 inches.
8. **Unlike Numbers** are those which express units of different kinds ; 3 feet ; 6 pounds.
9. **Numbers** are expressed by figures, letters, or words.
10. **Notation** is the writing of numbers, and **Numeration** the reading of numbers.

11. The Arabic Notation is the method of writing numbers by figures.

12. The Roman Notation is the method of writing numbers by letters thus ; I., V., X., L., etc.

13. A Period is a number group of three orders of units, counting from the right to the left.

14. Writing and Reading Numbers.—*Begin at the left and write each period as though it stood alone, and each successive period with hundreds, tens, and units, filling all vacant places and periods with ciphers, pointing off the periods as you write. Each period, excepting the left hand one, must be full. To read, begin at the left, and give to each period excepting the last the name of its lowest order.*

THE FOUR FUNDAMENTAL PROCESSES.

15. Addition is the uniting of two or more numbers.

16. The Amount is a number obtained by addition.

17. Principle.—I. *Only like orders of units can be added or subtracted.*

18. Important Fact.—I. *Each ten of the sum of the units of any order, integral or decimal, is a unit of the next higher order.* II. *A unit of any order of any number in the decimal scale has the value of ten units of the next lower order.*

19. Subtraction is the taking of one number from another.

20. The Minuend is a whole and the Subtrahend is a part of the minuend given.

21. The Difference or Remainder is a part of the minuend to be found.

22. The Minuend equals the subtrahend and remainder.

23. Multiplication is the short way of uniting two or more numbers, or the repeating one of two numbers as many times as there are units in the other number.

24. The Multiplicand is one of the numbers united.

25. The Multiplier shows how many of these numbers are united.

26. The Product is the result obtained by multiplication.

27. The Factors are the multiplier and multiplicand.

28. Principles.—I. *The repeating of a number does not change its unit.* II. *The multiplier is an abstract number.* III. *The multiplicand may be either abstract or concrete.* IV. *The multiplicand and product have like units.* V. *The product divided by either factor gives the other factor.*

29. Important Facts.—I. *Each removal of an integer one place to the left, by annexing to it either a cipher or digit multiplies the number by ten.* II. *A decimal is increased ten times when the decimal point is moved one place to the right.* III. *When one factor is an integer, the number of decimal places in the product equals the number of decimal places in the other factor.* IV. *There must be as many decimal places in the product, as there are in both factors, counting from the right of the product.*

30. Division is the process of separating a number into equal parts, or of comparing two numbers of the same kind, measuring one by the other.

31. The Dividend is the number to be divided or measured.

32. The Divisor is the number by which the dividend is measured.

33. The Quotient is the number of times the divisor is used in measuring the dividend.

34. Principles.—I. *When the divisor and dividend are like numbers, the quotient is an abstract number.* II. *When the divisor is an abstract number, the dividend and quotient are like units.*

35. Important Facts.—I. *If more decimal places appear in the divisor than in the dividend, they must be made equal in number before dividing.* II. *When the number of decimal places in the dividend and divisor are equal the quotient is a whole number.* III. *There must be as many decimal places in the quotient as the number of decimal places in the dividend exceed those in the divisor.* IV. *Rejecting ciphers from the right of a decimal number does not change its value, only its name.* V. *Prefixing ciphers to a decimal number decreases its value 10 times for each cipher prefixed.*

To Reduce a Decimal to a Fraction, write the given number without the decimal point, for the numerator, and under it write its denominator.

To Reduce a Fraction to a Decimal, annex a cipher or ciphers to the numerator, and divide the number thus formed by the denominator, pointing off from the right of the quotient as many places as there were ciphers annexed.

36. How to Write Decimals.—*Write the numerator, and from the right of the expression point off toward the left as many decimal places as there are ciphers in the denominator, prefixing ciphers if necessary to make the required number of decimal places. (See pages 22, 23, and 24).*

SHORT METHODS.

37. To Find the Cost of Articles sold by the 100 pounds, 1000 pounds, or by the Ton of 2000 pounds. *Point off from the right of the number denoting the quantity as*

many places as there are ciphers in the unit used, and multiply the price by the result. For the ton point off three decimal places, divide the result by two, and multiply the price of a ton by this number.

38. An Aliquot part of a number is one of the equal parts of that number. $3\frac{1}{3}$, $6\frac{1}{4}$, 10, $12\frac{1}{2}$, $16\frac{2}{3}$, 20, 25, $33\frac{1}{3}$, and 50 are aliquot parts of 100.

By using aliquot parts of a number in computations, operations in arithmetic are frequently very much shortened.

39. Cancellation is the striking out of equal factors from both dividend and divisor, thus shortening the arithmetical work. **PRINCIPLE.**—*Dividing both dividend and divisor by the same number does not alter the value of the fraction.*

DIRECTIONS FOR THE USE OF SIGN EXPRESSION IN ARITHMETIC.

Terms are expressions separated by *plus* or *minus*. The power of the sign \times or $+$ does not extend beyond the $+$ or $-$ sign. Operations indicated by the two signs \times or $+$ must be performed before *adding* or *subtracting*, for a $+$ or $-$ sign effects the *whole term* that follows, not a *part*. Ex., $6 + 8 \div 2 - 3 = 7$. When the term contains both the signs \times and $+$, the operations are performed in the order in which they occur. Ex., $8 + 6 + 2 \times 4 + 10 + 2 = 15$.

40. How to Express Numbers.—Pupils should be trained to a power of seeing beneath the arithmetical symbols in which number relations are expressed the real numbers, and thus the real relations. Conversely, they should be trained to express in the sign language any of the various relations and groups of relations that they may from time to time discover in their study of numbers. Below is given an expression form for each of the 10 written problems on pages 115 and 116 of this book. These problems, thus expressed, were placed on paper as a *new exercise* in 12 minutes by a girl 13 years of age.

1. $\frac{\$7 \times 4 \times 64 \times 7}{2 \times 128} = \$$
 2. $\frac{\$3 \times 36 \times 24 \times 11}{8 \times 27 \times 2} = \$$
 3. $\frac{\$4 \times 19 \times 13 \times 7}{2 \times 3 \times 2} = \$$
 4. $\frac{\$28 [(36 + 27) \times 2] \times 14 + (36 \times 27)}{100 \times 9} = \$$
 5. $\frac{\$19 \times 100 \times 80 \times 144}{2 \times 8 \times 4 \times 1000} = \$$
 6. $\frac{40 \times 30 \times 4}{15 \times 5} = \text{planks.}$
 7. $\frac{30 \times 3 \times 21}{2 \times 7} = \text{sq. feet.}$
 8. $\frac{\$5 \times 52 \times 32}{4 \times 9} = \$$
 9. $\frac{\$18 \times 30 \times 15 \times 2}{2 \times 1000} = \$$
 10. $4 [(160 \times 2) + (120 - 8) 2 + (160 - 8)] = \text{sq. feet.}$
-

MULTIPLES AND MEASURES.

41. A Prime Number is one which cannot be exactly divided by any other number except unity and itself; as 2, 3, 5, 7, 11, 13.

42. A Composite Number is one composed of a fixed set of prime numbers; as 4, 6, 8, 9.

43. An Odd Number is a number which is not exactly divisible by *two*; as 3, 5, 7, 9.

44. An Even Number is a number that is exactly divisible by *two*; as 4, 6, 8, 10.

45. The Factors of a number are those numbers which multiplied together produce the number.

46. Numbers are Prime to each other when they have no common divisor.

FRACTIONS.

47. A Fraction is one or more of the equal parts of a unit. The expression $\frac{3}{5}$ means that the unit has been divided into *five* equal parts, and that *three* of these parts are considered. In the fraction $\frac{3}{5}$, the lower figure shows the number of parts into which a whole thing has been divided, and is a *divisor*; it also indicates the *name* of each part, and is called the *denominator*. The figure above the line shows the *number* of parts considered, and is called the *numerator*.

48. The Terms of a Fraction are the numerator and denominator.

49. A Proper Fraction is a fraction the numerator of which is less than the denominator; as $\frac{3}{5}$, $\frac{1}{2}$.

50. A Mixed Number is a whole number and fraction written together; as $3\frac{1}{2}$.

51. An Improper Fraction, so called, is a fractional expression the numerator of which equals or exceeds the denominator; as $\frac{5}{4}$, $\frac{7}{3}$.

52. Similar Fractions are like parts of the same unit.

53. The Reciprocal of a Number is *one* divided by that number.

54. The Reciprocal of a Fraction is the fraction inverted.

55. A Whole Number may be expressed as a fraction with any given denominator. Thus, $9 = \frac{9}{1}, \frac{9}{2}, \frac{9}{3}$.

56. Reduction of Fractions is the process of changing their **forms** without changing their **values**. A fraction is reduced to its **lowest terms** when the numerator and denominator are prime to each other. A fraction is reduced to **higher terms** by multiplying both numerator and denominator by the same number. **To Reduce a Fraction to Lowest Terms**, *divide both terms by their Greatest Common Divisor or Measure; generally this divisor may be found by inspection.* **To Find the Greatest Common Measure**, *divide the greater number by the smaller, then this divisor by the remainder, continuing until there is no remainder. The last divisor is the G. C. M. required.* **PRINCIPLES.**—I. *Multiplying the numerator or dividing the denominator multiplies the fraction.* II. *Dividing the numerator or multiplying the denominator divides the fraction.* III. *Multiplying or dividing both terms of a fraction by the same number does not change its value.*

Reduce $\frac{333}{259}$ to its lowest terms.

Since no common factor can readily be discovered, we find the G. C. M.

$$\begin{array}{r}
 259)333(1 \\
 \underline{259} \\
 74)259(3 \\
 \underline{222} \\
 37)74(2 \\
 \underline{74}
 \end{array}$$

Divide 259 and 333 each by 37, their G. C. M. Then $\frac{333}{259} = \frac{9}{7}$.

57. A Common Divisor of two or more numbers is any *exact* divisor common to those numbers.

58. The Greatest Common Divisor of two or more

numbers is the *greatest* exact divisor common to those numbers.

59. To Reduce Fractions to Similar Fractions in lowest terms, find the least common multiple of their denominators. Divide this multiple by the denominator of each fraction, multiplying the numerator of the first fraction by the first quotient, the second numerator by the second quotient, and so on. Multiply both terms of each fraction by the number of times its denominator is contained in this L. C. M.

Reduce $1\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$ to like fractions in lowest terms.

Reducing $1\frac{1}{2}$ to an improper fraction, and $\frac{3}{4}$ to its lowest terms, we have $\frac{3}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$ with which to operate.

Always find the L. C. M. by **inspection** when the denominators are small.

$$\begin{array}{r} 2) 6, 4, 9 \\ 3) 3, 2, 9 \\ \hline 1, 2, 3 \end{array}$$

$$2 \times 3 \times 2 \times 3 = 36 \text{ L. C. M.}$$

$$(36 \div 6) \times 11 = 66$$

$$(36 \div 4) \times 3 = 27$$

$$(36 \div 9) \times 2 = 8$$

$$\text{Ans. } \frac{66}{36}, \frac{27}{36}, \frac{8}{36}$$

60. To Find the L. C. M. of Two or More Numbers, divide by any prime number that is an exact divisor of two or more of the numbers, writing the quotients and undivided numbers below. Divide these numbers as before, continuing until the quotients and undivided numbers are prime to each other. The product of these prime factors and undivided numbers is the L. C. M.

61. A Multiple of a number is one of which that number is an exact divisor. A multiple that two or more numbers have in common is called their *common multiple*. The least number that will exactly contain two or more numbers is the *Least Common Multiple* of those numbers.

62. To Add Fractions, make them similar, add the numerators, and under the sum write the common denominator.

63. To Multiply Fractions, reduce mixed-numbers and integers to fraction-forms; multiply all the numerators together for the numerator, and all denominators together for the denominator of the simple fraction or product.

Ex. Multiply $\frac{3}{4}$ by $\frac{7}{8} = \frac{3}{4} \times \frac{7}{8} = \frac{21}{32}$.

64. To Subtract Fractions, make them similar, subtract their numerators, and under the difference write the common denominator.

65. To Divide a Fraction by a Fraction, reduce mixed numbers and integers to fraction-forms, and multiply the dividend by the reciprocal of the divisor.

Ex. Divide $\frac{11}{12}$ by $\frac{7}{8} = \frac{11}{12} \div \frac{7}{8} = \frac{11}{12} \times \frac{8}{7} = \frac{22}{21}$.

DENOMINATE NUMBERS.

66. A Simple Number is a number composed of integers of the same kind.

67. A Denominate Number is a unit of weight or measure, and is composed of a denominate unit or units.

68. A Simple Denominate Number is one composed of denominate units of *one kind*; as 2 yd., 3 lb. A compound denominate number is composed of denominate units of *two or more kinds*; as 4 lbs., 3 oz., 12 pwt..

69. Reduction of Denominate Numbers is the process of changing them from one denomination to another without changing values. There are two processes of Reduction,—descending, changing a compound denominate number to units of lower denomination by multiplication; and ascending, changing a denominate number to an equivalent number of a higher denomination by division.

PROCESSES OF REDUCTION DESCENDING AND ASCENDING.

Ex. 1. How many pints are 17 gal. 3qt. 1pt.?

Ex. 2. Reduce 2pk. 3qt. 1pt. to the decimal of a bushel.

Ex. 1. *Analytical Process.*

Ex. 2. *Common Process.*

$$17 \times 4 \text{ qt.} + 4 \text{ qt.} = 71 \text{ qt.}$$

$$2)1.0 \text{ pt.}$$

$$71 \times 2 \text{ pt.} + 1 \text{ pt.} = 143 \text{ pt.}$$

$$8)3.5 \text{ qt.}$$

$$\text{Hence, } 17 \text{ gal. } 3 \text{ qt. } 1 \text{ pt.} = 143 \text{ pt. Ans.}$$

$$4)2.4375 \text{ pk.}$$

$$.609375 \text{ bu.}$$

70. To Reduce a Denominate Fraction to Integers, change the fraction as far as possible to an integer of the next lower denomination. If there is a fraction in this result, continue the operations as far as required.

Ex. Reduce $\frac{7}{8}$ of a bushel to units of smaller denominations.

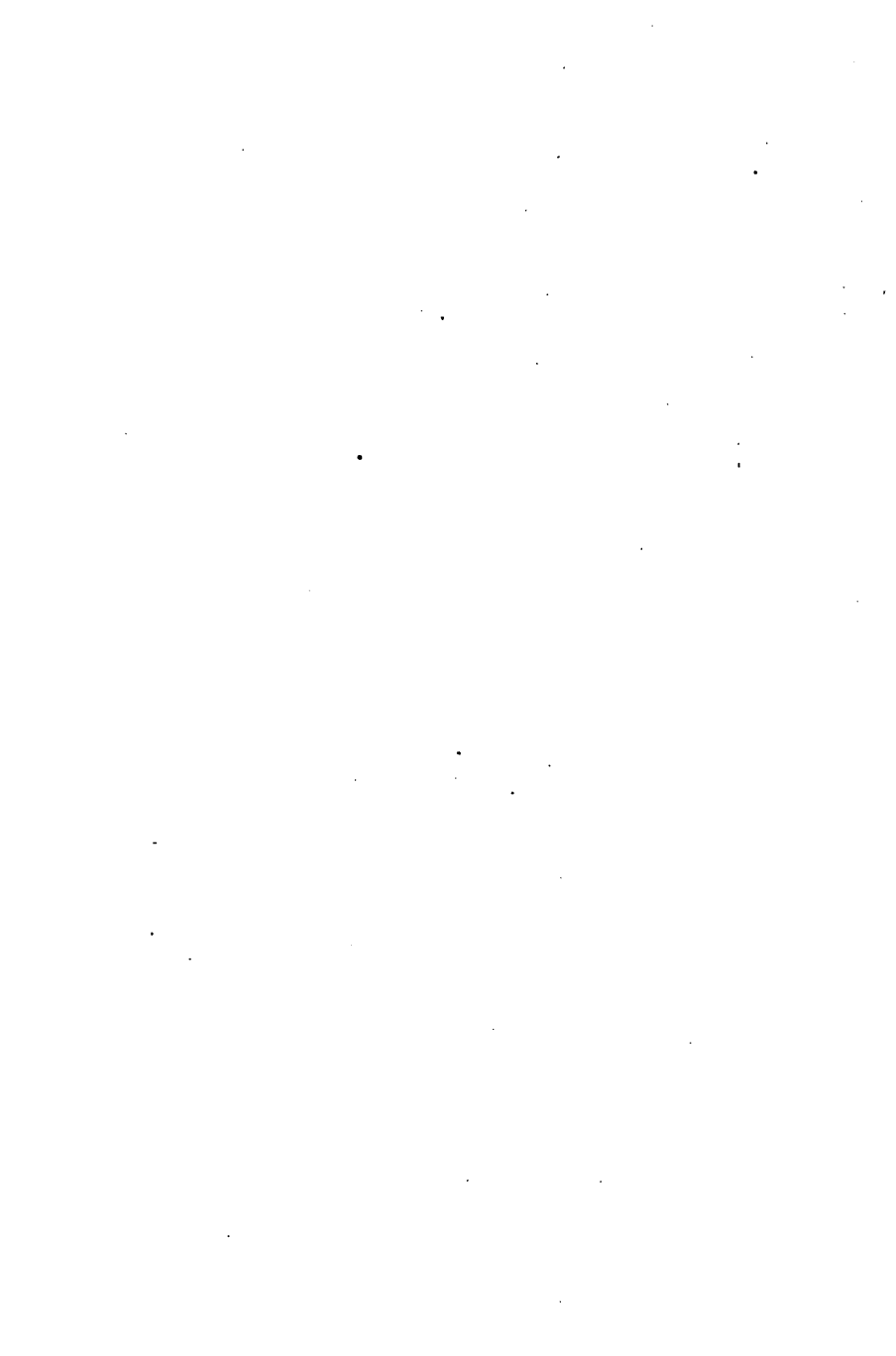
$$\text{Solution. } \left\{ \begin{array}{l} \frac{7}{8} \text{ bu.} = \frac{7}{8} \text{ of } 4 \text{ pk.} = 3\frac{1}{2} \text{ pk.} \\ \frac{1}{2} \text{ pk.} = \frac{1}{2} \text{ of } 8 \text{ qt.} = 4 \text{ qt.} \\ \frac{1}{4} \text{ qt.} = \frac{1}{4} \text{ of } 2 \text{ pt.} = \frac{1}{2} \text{ pt.} \end{array} \right.$$

$$3 \text{ pk. } 0 \text{ qt. } 1\frac{1}{2} \text{ pt. Ans.}$$

71. To Reduce a Denominate Fraction to a Fraction of a Lower Denomination, multiply the fraction successively by the numbers of the scale that will reduce it to the required denomination.

72. To Reduce a Denominate Fraction to a Fraction of a Higher Denomination, divide the fraction successively by the numbers of the scale that will reduce it to the required denomination.

73. To Reduce a Denominate Number to a Fraction of a Higher Denomination, change the given number to the lowest denomination mentioned for the numerator, and a unit of the required denomination to the same denomination for the denominator of the fraction.





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